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This Association, as a body, is not responsible for the statements or opinions of any of its members.

THE DRIVEN WELLS AT THE MT. WASHINGTON,

A HOTEL AT BRETTON WOODS, N. H.

A CORRECTION.

BY WM. PAUL GERHARD, CONSULTING ENGINEER, NEW YORK CITY.

[*June 25, 1903.*]

In the discussion on the paper by Mr. George Bowers, City Engineer of Lowell, Mass., on "Underground Water," which appeared in the June, 1903, number of the JOURNAL OF THE NEW ENGLAND WATER WORKS ASSOCIATION, I find reported certain statements by Mr. Charles N. Taylor, Contractor and Engineer, of Wellesley, Mass., which contain errors that seem to call for a correction. I greatly regret not having been present at the meeting to answer Mr. Taylor then and there and to correct those errors.

First of all, let me state that I was the engineer selected by the Mt. Pleasant Hotel Company to prepare plans and specifications and superintend the construction of their new water-works plant at Bretton Woods, N. H.

The true history of this little plant is as follows: Before the new hotel called "The Mt. Washington" was contemplated, the other hotel of the Mt. Pleasant Hotel Company, "The Mt. Pleasant," was supplied with water from a deep artesian well with a steam pump; the depth of this artesian well is stated variously at 396 and 408 feet. Besides this deep well the company had seven other shallow driven wells in a basin of gravel near the golf grounds of the hotel. These wells varied in depth from 20 to 23 feet; they were 2½ inches in diameter and were reported to yield an average of about 20 gallons per minute each. Owing to the large consumption of water, it was necessary to keep the artesian well pump, as well as the electric pump operating the shallow wells, going about eighteen hours a day.

When I was requested, in 1901, by the company to take the matter of water supply in hand, it occurred to me, after a preliminary survey of the locality, as the first thing, that if it were possible to obtain from some mountain brook a gravity supply sufficient in quantity for the new, as well as the old, hotel, this would be the most desirable plan, as it would do away with the cost and nuisance of pumping. I at once arranged for proper surveys to be made for a new supply, in which I was ably assisted by Mr. Ray T. Gile, Civil Engineer and Surveyor, of Littleton, N. H. Summing up the results of the survey, I would say that we found it possible, by going a little over four miles along the base road running from Fabyans to near the foot of the cogwheel railroad up Mt. Washington, and thence following a side line into the woods toward the foot of Mt. Clinton, to obtain a very large supply of pure mountain-brook water. This plan I recommended to the company, but for certain reasons, among which I mention only the requirements of right of way, it was not possible for the company to adopt at that time the gravity system, which would have secured for both hotels an ample supply. I therefore received orders to provide plans and specifications for a driven-well system.

After the preparation of plans and specifications for wells, pumps, and tanks, a contract was let to the Smith & Thayer Co., of Boston, Mass., on December 19, 1901, for a water-supply plant comprising a battery of twelve 5-inch driven wells (this was afterwards increased to seventeen); three large wooden storage tanks of a combined capacity of 150 000 gallons; a pumping station with one house and one fire pump, the former of 350, the latter of 830, gallons per minute capacity, both of them operated electrically and both made by the Knowles Steam Pump Works; also for pipe lines, gate valves, and hydrants between the tanks and the pumping station, and between the latter and the hotel.

Subsequently, all objections to a gravity line having been removed, I was directed to make plans and specifications for a gravity line, and a second contract was let, also to the Smith & Thayer Co., on March 3, 1902, for a gravity supply line from Clinton Brook.

The two hotels were thus supplied by a double system of water

supply, so that in case of a break in the gravity line or a failure in the supply from the brook, the hotels could be supplied from the wells and the pumping station. Ordinarily, however, the gravity supply was intended to, and did, fulfil all requirements. As subsequent facts proved, it was lucky for the company that both supplies were provided, for about four weeks ago, during the unusual drought, and while forest fires were raging, the Clinton Brook supply became entirely exhausted for the first time in many years, and recourse had to be taken to the pumps. So much as to the history of this water-supply plant.

Mr. Taylor states, on page 135* of the JOURNAL, that he had a contract to procure a gravity system for the hotel by going up Mt. Washington. If so, it was as a sub-contractor for pipe laying; for, as stated above, the plans for this system were prepared in my office and the contract was let to the Smith & Thayer Co.; Mr. Taylor was one of the bidders for the work, but failed to secure it. He subsequently appeared on the ground and had charge, for the Smith & Thayer Co., of the pipe-laying, but of the pipe-laying only. The pipes, specials, valves, etc., for the gravity line were bought and furnished by the Smith & Thayer Co., and not by Mr. Taylor.†

With regard to Mr. Taylor's statement, referring to the wells, that "they have continued to experiment with them until they got disgusted, having spent in the neighborhood of $40 000, and were still pumping nothing but air," the truth of the matter is as follows:

The seventeen wells were driven by experienced well drivers by means of 8-inch casings, and when the proper depth of from 30 to 40 feet was reached (a few wells are 27 feet deep), the 5-inch well pipe proper was inserted and the 8-inch casing withdrawn. The 5-inch wells were all connected to a suction line of galvanized iron, with very heavy special galvanized iron flanged fittings, put together with gaskets and bolts in the very best manner. The suction pipe was 5, 6, 8, and 10 inches in diameter and was tested and shown to be tight before the same was covered up. The aggregate yield of the wells was 1 050 gallons per minute. This part of the work was completed in the early part of the summer of 1902, and the two pumps referred to were also set, but it was not

* Vol. 17.

† This was the information given me by Mr. Smith, of the Smith & Thayer Co.

possible to get the electric current to run these pumps before the fall of the year. Meanwhile, the gravity supply line furnished an abundance of water, and other pressing work prevented the early completion of the electric conduits for the power to run the pumps. It was some time in September when the current was first turned on, and the pumps pumped water fairly well, — so much so that the contractors expressed themselves as satisfied with the pumps. The writer happened not to be present when these pumps were first started, and naturally he insisted upon a proper test of the pumps before acceptance of the same. When this test was made, late in September, a representative from the contractors, and also Mr. DeLaval, the Superintendent of the Knowles Steam Pump Works, were present, and at that time the pumps gave some trouble, caused by air getting into the suction line and into the pumps. Unfortunately, the season in the White Mountains closes early, and in the first week of October it was necessary to shut down the pumps and drain them on account of freezing weather, and not until the spring of 1903 were the pumps started again. It is not true that the company spent $40 000 on the wells and pumps, for the cost of the seventeen wells was about $8 560, and the cost of the two pumps about $8 600; therefore the entire expenditure for the pump and well plant was about $17 150.

The statement that the engineer in charge of the work was at a loss to know what to do about it is also incorrect. At the time when the pumps were shut down, he was not quite sure whether there was any possible leak in the wells or in the suction line. The two pumps operated satisfactorily from a mechanical point of view, and were accepted last year. In fact, the entire contract of the Smith & Thayer Co. was accepted and settled except a few extra items of no interest to this discussion.

As to the use of a vacuum pump, this was suggested by Mr. DeLaval, of the Knowles Steam Pump Works. The writer requested him to give an estimate of cost, but this came up to almost $2 000 and was held in abeyance as probably unnecessary.

Early in the spring of 1903 the writer went to Mt. Pleasant, after all preparations had been made to start the pumps by packing the same and turning on the electric dynamos. *Nothing had*

been done since the previous fall to either the pumps or the wells. When the current was first turned on and the pumps set in motion, to the great satisfaction of all present the pumps discharged their full capacity of water from the series of driven wells. During this test of the pumps two or three bad leaks were found at the well caps of the wells, but these were promptly tightened up, and no further leaks have been discovered since.

I quote from a report received on June 19, 1903, about the operation of the larger or fire pump, which report was written by Mr. Anson S. Rice, the resident engineer in charge of the power plant and of these pumps, as follows:

" I gave the wells a very good test. I ran the big fire pump on them for one and one-half hours and the discharge did not seem to vary any with 15 inches vacuum on the gage. After pumping I measured the water in the wells, and in Wells No. 1 and 13 the water was 1 foot lower than it had stood at a former measurement taken two weeks before; in the rest of the wells the water was 6 inches lower, with the exception of Wells No. 15, 16, and 18, in which the water level was only lowered 2 inches."

Certainly this is a most satisfactory showing.

So far, my only explanation of the failure of the pumps and wells to perform the duty at the one trial made on a certain day in the fall of 1902 is that the water level in the underground basin in which the wells are driven may have been unusually low at that season of the year, while in the spring of this year there seems to have been an abundance of underground water, which is fed from the snow and ice on the peaks and in the ravines of some of the mountains belonging to the Presidential Range. There may also have been some air leaks in the suction line which have since rusted up, and a few air leaks in the well caps which, as stated above, we did find and tightened.

I wish to say that I have no doubt that even now there is some air delivered with the water by the pumps from the wells, for, as Mr. Bowers has well described it, there is always more or less of this difficulty with any driven-well system, but inasmuch as the pumps discharged at the rated capacity it has not been found necessary at this writing to put in the rather expensive and some-

what complicated automatic vacuum pump which was suggested to relieve the trouble.

DISCUSSION.

MR. CHARLES N. TAYLOR (by letter, July 25, 1904). Referring to the article written by Mr. William Paul Gerhard, entitled "A Correction," I find that in order to defend myself I must question some of the statements which he has made. I stated in the discussion referred to by Mr. Gerhard that I had the contract for laying the pipes, setting the hydrants, etc., for supplying water to the new Mt. Washington Hotel, and I would refer any one questioning this to the Donaldson Iron Company, from whom I bought the pipe; the Norwood Engineering Company, who furnished me with the hydrants; and the Ludlow Valve Company, who furnished me with the valves. My contract was with the Smith & Thayer Company, who had the contract for the entire work and sub-let to me the pipe work.

Mr. Gerhard questions my statement in regard to the experiments with the wells and the cost of the plant, but he admits that the "pumps gave some trouble, caused by air getting into the suction line and into the pumps." He also admits that they did not succeed in pumping any water from the driven wells until the next spring. I might add right here, one reason why they could not pump water, in my opinion, was that the wells were of different depths, and that to my knowledge one dry well was connected to the system, and other wells were connected which would yield only a very few gallons of water. This would account for the test being satisfactory in the spring when the ground water was up to nearly the surface of the ground.

In the discussion referred to by Mr. Gerhard, I was seeking information as to the advisability of connecting wells which yielded a small amount of water with better wells, and it was far from my intention to question Mr. Gerhard's work, and that is the reason I did not mention his name. In regard to the misstatement which Mr. Gerhard claims I made as to the cost of the pumping plant, I will say that he has omitted in his estimate the cost of the pipe mains, for which Smith & Thayer paid me nearly $20 000; he has also omitted the cost of the three wooden

tanks, which I should judge cost between $3 000 and $4 000. The above items added to the cost of the wells and the pumps, as given by Mr. Gerhard, makes a total of practically $40 000, as stated by me in the above-mentioned discussion. The cost of the gravity pipe line was over $20 000, and is not included in the above.

EXTRACTS FROM A "REPORT RELATIVE TO SUPPLYING THE CITY OF NEW YORK WITH PURE AND WHOLESOME WATER, NOVEMBER, 1833."

COMPILED BY JAMES M. BETTON.

[*Read February 10, 1904.*]

The following extracts are taken from a "Report of the Commissioners under an act of the Legislature of this State, passed February 26th, 1833, relative to supplying the City of New York with Pure and Wholesome Water," — the report being printed by Peter Van Pelt, Frankfort Street, 1833, and dated November, 1833.

The report was referred to the Committee on Fire and Water, with directions to have five hundred copies printed, including sundry maps and profiles.

Canvas White and David B. Douglass, Esquires, civil engineers, were engaged to make separate and distinct examinations of the Croton, Sawmill, and Bronx rivers in the counties of Westchester and Putnam, together with their several tributaries, and to furnish the commissioners with a map and profile of the country, and their opinion of the quality of the water, the supply that might be depended on in all seasons, and the practicability of conveying it to the city at an elevation of sufficient height that would preclude the use of machinery, and answer all the purposes contemplated.

The engineers were also instructed to designate the best and most feasible route for conducting the water, the most fit and proper manner for constructing the conduits and reservoirs, the probable amount of damage that might be sustained by the proprietors of the water to be taken, and of the land it might be necessary to occupy in constructing the required conduits and reservoirs, together with the total amount of the cost to the city for completing and putting into operation the whole project.

Canvas White was prevented from reporting because of previous engagements on the Raritan and Delaware Canal, and on account of frequent and heavy rains during the summer, flooding the works, but Mr. Douglass submitted a full and ample report, which is given in detail with numerous profiles and sections.

Two routes were proposed for bringing the waters of the Croton and its tributaries: The Inland or Sawmill River Route and the Hudson River Route, the former at an estimated expense of $5 827 237 and the latter at $4 718 197, each terminating in a reservoir at Thirty-eighth Street and Fifth Avenue, to contain between fifty and sixty millions of gallons, the water level being 117 feet above the tide.

It was estimated that the population when the work would be completed would not be less than 300 000, and the supply per capita was based upon various investigations made by the commissioners, who learned that the London water companies furnished 162 gallons for each house per diem, or 27 gallons to each inhabitant, counting six persons to each house. The city of Philadelphia, in 1832, supplied 13 806 houses, factories, etc., with 2 000 000 gallons per day, equal to 146 gallons to each establishment, or about 24 gallons to each inhabitant, allowing six persons to a house; Edinburgh and Leith distributed about 15 gallons to each inhabitant, 130 000 persons requiring 1 950 000 gallons every 24 hours, but could increase their supply to 2 661 120 gallons per day, or 20½ gallons per capita.

From these observations the commissioners adopted 22 gallons per diem for each inhabitant of the city of New York, making it necessary to supply 6 600 000 gallons per day. It appears that the Manhattan Company had at that time twenty-five miles of pipes laid in the city, obtaining their supply from a well on Reed Street, the water from which is described as "disagreeable and unwholesome," and had offered to dispose of their works to the corporation, which had also about ten and a half miles of pipes, extending from their reservoir in Thirteenth Street.

The Manhattan Company was organized with a charter drafted by Aaron Burr, allowing them banking privileges, of which they have fully availed themselves, existing to-day as the second oldest bank in New York, and preserving on their premises a tank of

considerable size, constantly filled with water, as a connection with their original charter.

Water obtained from wells was not good in the thickly settled parts of the city, and had changed within the recollection of hundreds, and the commissioners concluded that a similar change might be expected in the northern portion of the city when that became built up also.

Attempts had been made to obtain water by boring, and a certain Mr. Levi Disbrow, who held a patent on improved instruments for penetrating or boring rock, had operated in twenty-three different sections of the city, and in but few instances had succeeded in producing good water. In seventeen cases he stopped at or before reaching rock, and penetrated the earth from 60 to 130 feet, and in six cases he penetrated the rock from 120 to 500 feet, his most successful operation being a deep boring for the Manhattan Company, corner of Broadway and Bleecker Street, 7 inches in diameter, 442 feet in depth, meeting rock at 42 feet, the water proving soft and wholesome, capacity 126 000 gallons in twenty-four hours.

Mr. Disbrow also sunk a well for the corporation at Thirteenth Street. This was 17 feet in diameter and 113 feet in depth, with three horizontal excavations of 4 feet in width and 6 feet in height, extending from the bottom of the well in the rock, two of them 75 feet and one 110 feet in length. This well produced 21 000 gallons in twenty-four hours, but the water was hard, strongly impregnated with some mineral substance, and unfit for drink or cooking, but before the horizontal openings were made the commissioners were assured the water was as pure and soft as that which descends from the clouds. This well, although very useful, was very expensive, costing, including the land, $57 972.38.

The commissioners estimate the present population at about 250 000, and as a large portion of the Twelfth Ward is under cultivation and will not require an immediate supply, deduct 12 000 as the probable population, leaving the population of the 14 lower wards at 238 000, or about 17 000 in each ward, and, allowing 22 gallons for each person, estimate the daily consumption of each ward as 374 000 gallons, and that 3 wells, similar to that of the Manhattan Company on Bleecker Street, in each

ward, or 42 in all, with their steam engines in constant operation will be required to supply the city.

They estimate that these 42 wells, including the land, engine, reservoir, etc., will amount to $2 518 825, and submit the following estimate of the annual expense of working an engine of 12 horse-power, night and day:

42 bushels of coal per day, at 21 cents, for 365 days .	$3 219.30
2 engineers and 2 assistants, at $6.00 per day . . .	2 190.00
Oil, tallow, etc., at 14 cents per day.	51.10
Wear and tear of machinery, at 30 cents per day . .	109.50
Annual expense per engine	$5 569.90
The annual expense of 42 engines would be	$233 935.00
Add the interest on the capital at 5 per cent.. . . .	125 941.00
Total annual expense for raising water from wells	$359 876.00

The commissioners wisely doubt whether a sufficient and wholesome supply could be obtained by boring, and note that a strong objection will arise from placing 42 steam engines in the densely settled parts of the city, to annoy and disturb a neighborhood with the unceasing noise and clatter of the machinery, the constant smoke of the furnaces, and the incessant discharge of steam, thus depreciating the value of property and driving from their vicinity every citizen whose means would permit him to seek for more peaceful and comfortable quarters, and taking also into consideration that the cost of bringing in the Croton water being assumed at $5 000 000, the interest on which is $250 000 or $109 876 less than it would cost to raise the water by machinery, conclude that the corporation must look outside of its own limits for an adequate water supply.

The commissioners note that the subject of supplying the city of New York with water is by no means a new project or of recent date, for as early as 1774, with a population not exceeding 22 000, works were commenced on the high ground to the northwest of the Collect Pond (which at the time of their report, in 1833, had been filled up and converted into building lots), under the directions of Christopher Collis, engineer, who constructed a spacious reservoir on the east line of Broadway, between Pearl and White streets, and sunk a well of large dimensions in the

vicinity of the Collect, a paper money amounting to £2 500, denominated water-works money, and bonds to the amount of £8 850 more, defraying the expenses thereof. This work was abandoned in an unfinished state in 1775, upon the occupation of the city by the British troops incidental to the Revolution.

In 1798 a committee of the council reported that a supply might be obtained from the River Bronx.

In 1799 the Common Council employed William Weston, civil engineer, to examine the River Bronx and report with plans and estimates, and in March of that year Mr. Weston made his report and seems to have held the opinion that the Bronx would give a supply but did not gage the river, further than to calculate the quantity contained in the Rye Ponds, its principal source; and no estimate of expense was furnished.

Nothing further was apparently done until 1822, owing probably to the incorporation of the Manhattan Company, April 2, 1799, who contented themselves by erecting works at Chambers and Reed streets and did not look for a foreign sup ply, the water they furnished being stated to contain by analysis 125 grains of foreign matter in the gallon.

In this year, 1822, a committee appointed by the mayor reported an examination of the Bronx and its lakes, and appointed Canvas White, Esquire, civil engineer, who did not report until 1824.

Mr. White proposed, by raising a dam of six feet at the upper Rye Pond and lowering the outlet, to obtain 6 600 000 gallons per day, or 3 600 000 more than the natural flow of the river in the dryest season, estimating the cost of bringing the water to a reservoir near the park as $1 949 542.

Nothing came of this, and, in 1825, the New York Water Works Company was incorporated, Canvas White, Esquire, being the engineer, and it was proposed to take its supply from the Bronx, it being estimated that 9 100 000 gallons could be delivered daily at a total expense of $1 450 000. The charter of this company proved defective, and, after legal complications incidental to an amendment thereof, the company was dissolved in 1827.

In 1831 the Board of Aldermen reported in favor of applying to the legislature for an act allowing the raising of money by loan

for the purpose of introducing a supply of pure water to the city, but this did not pass into a law.

In 1832 DeWitt Clinton, Esquire, civil engineer, was employed by the Common Council to examine the Croton River and report the best plan of crossing the Harlem River; he reported, in December of that year, in favor of an open aqueduct following the line of the Croton and Hudson rivers and crossing the Harlem River on an arch 138 feet high and 1 000 feet in length, estimating the total cost at $2 500 000.

In 1833 the Common Council petitioned for an act, under the authority of which this report was made, this becoming a law of the state of New York, February 26, 1833.

This report is fully illustrated by maps and profiles, and is signed by Stephen Allen, Saul Alley, William W. Fox, Chas. Dusenberry, and Benjamin M. Brown, commissioners.

Supplementary to this report follows an address of John L. Sullivan, civil engineer, a co-patentee with Levi Disbrow in 1833, demonstrating the advantages of a rock water company with banking privileges, and also a proposition to the Manhattan Company to fill their aqueduct with rock water, an opportunity being afforded to such as were disposed to subscribe to the stock thereof, a capital of $2 000 000 being named, one half of which was to be appropriated to the water works and the other million to a banking capital.

The petitioners begin their address by respectfully representing " that being patentees and proprietors of those instruments by which the discovery of the deep seated pure water beneath this city was made, and by which alone it is accessible "— evidently having a stronger and firmer belief in the validity of the current Letters Patent than has been experienced and demonstrated by later generations. They desired to lay down pipes in any usual manner through the streets, to deliver water into the houses of those disposed to take it, on terms that should not exceed the average of the water rates at Boston and Philadelphia.

It was not proposed to make costly wells in the deep sands of the city, but rather to avoid such, utilizing the iron tube with a flat socket joint devised for this work, the estimate for each boring being,—

Lot	$2 000.00
Boring, pump, and engine	5 000.00
Buildings and cistern	3 000.00
Total	$10 000.00

sufficient to, probably, raise 130 000 gallons in twenty-four hours, if constantly in operation, which, at 40 gallons each, was considered sufficient for 3 000 families. The utmost annual expense was estimated as:

Two men	$730.00
Fuel, 187 tons anthracite, at $8.00	1 496.00
Oil and repairs, 10 per cent.	222.00
Deterioration of machinery, 10 per cent.	222.00
or	$2 670.00 each well.

Thirty-one of these stations were proposed, and, as an instance of the economy, the expense of one horse-power is stated as ten pounds of coal per hour, or sixteen tons per year, costing at $6.00 per ton, $96.00; and it was further suggested that the surplus power from each engine could be devoted to some mechanical work in exchange for the necessary attention, thus saving the item of attendance and perhaps some part of the fuel.

Incidentally, it is mentioned that some of the most frequented hotels in New York pay (it is stated) for rock water brought in casks about $400 a year, and that one boring near the park might supply all the principal hotels and all have pure baths.

The probability of conflicting with the existing Manhattan Company is discussed and the point advanced that there is room and occasion for two companies, and the danger of trusting to a natural water supply, owing to the extraordinary evaporation in this, the dryest climate known, is advanced, and the practical John L. Sullivan supplements his paper with a "Notice of an invention called a Steam Camel for lifting a vessel over a shoal."

In a further report, February 16, 1835, the water commissioners mention having recommended, November 12, 1833, the Croton River as the only pure source of supply, and pass to a consideration of all matters relative to supplying the city with pure and wholesome water, among them being a plan to convey either six or sixteen million gallons from the mouth of the Croton and at an elevation of one hundred and twenty-five feet above low water

at New York and deliver same to the same height by means of iron pipes, which plan was shelved on account of engineering discrepancies.

They refer to Loammi Baldwin's report on the subject of introducing pure and wholesome water into the city of Boston, the number of wells in that city being 2 767, of which 682 were unfit for use, 7 city wells only yielded soft water and 33 were deep borings, only 2 of which furnished soft water.

A discussion follows of the plan of Bradford Seymour, of Utica, dated November 21, 1834, involving the erection of a permanent dam across the Hudson River at or near the site of the old State Prison, at the foot of Amos Street, to raise the surface of the water from 18 to 24 inches above high tide, the expense being estimated by Mr. Seymour at $1 250 000, and for the construction of as many ship locks as may be proper, $140 000 each, $100 000 to $200 000 more being considered as necessary if a lock in the center of channel is provided.

The advantages, briefly stated, are the purity of the waters; the formation of a hydraulic power of 30 000 horses, 27 000 of which may be employed for manufacturing and 3 000 for elevating the water to reservoir; all bars or " overslaughs " above the dam will be removed by the down current; a safe connection from the city to Albany on the ice for three months in the year furnished; the danger from freshets overcome; and the advantage of solid and pure ice at small expense gained.

The commissioners did not deem it their duty to incur any engineering expense in the examination of this scheme, stating they considered that in locking vessels through the dam large quantities of salt water would be admitted, unfitting the supply for domestic use at least; that the consent of the state of New Jersey would have to be obtained, as well as that of the United States; that the number of vessels passing would cause the dam to be considered a hindrance to navigation; that they could find no data in the office of the street commissioners from which to estimate the difficulties to be encountered in building the dam; that the raising of the water would cause damage to low-lying lands; that the closing of the river by ice for three months in the year would cause more injury to navigation than the privilege

of proceeding to Albany on the ice, or of procuring a supply of that article would produce benefits. They also considered the damage incidental to the destruction of the shad fishery, and conclude, upon the opinion of Frederick Graff, superintendent Fair Mount Water Works, that a head of twenty-four inches will not answer the purpose intended, owing to the short space of time the wheels would work, and to raise the level higher would destroy so much land that the damage claims furnish a reason for abandoning the project, let alone the injury to the navigation of the river, besides the cost, estimated by Mr. Graff at about four millions.

Mr. Graff, while thinking that if a bridge could be built across the Hudson, without injury to the trade of this great river, a supply of water might be obtained from the Passaic Falls, concludes that the only safe resource to be relied on is the Croton.

At that day the highest building, that of the new university, was 108 feet above tide water, and the surface of the proposed reservoir was to be 114 to 116 feet above the same base.

In discussing the question of revenue the following facts appear: The Manhattan Company apportion their charge in accordance with the number of fireplaces in the dwellings supplied, small houses containing from one to three fireplaces paying $5.00 per annum, while houses of the largest class pay $15.00, the average of the charge for dwellings being $9.63, if occupied by one family, $3.00 being added for each additional family; grocery stores pay $10.00 and bake houses $10.00 for each oven, larger consumers by agreement, the laying and repairing of the lateral pipes being done at the expense of those receiving the water. As a comparison, in Boston, one thousand families were supplied with water by the Boston Aqueduct Company at an annual charge of from $10.00 to $12.00 each family; in Providence the charge was $10.00 per annum for a family of six persons, and in Albany twelve hundred dwelling houses were supplied at rates varying from $6.00 to $16.00. In London the general average was about $8.00, 21 steam engines of 1340 horse-power being employed to raise the water. In Philadelphia a family of six persons paid only $5.00 per annum.

The estimated revenue from the proposed works in New York

City was $310 516, based on 20 000 water takers at $8.00 each. Among these 20 000 houses, 2 000 baths were estimated. There were 60 steam engines in the city used for mechanical purposes, which consumed about 45 000 gallons per day, for which a rate of about $35.00 was proposed.

Closing the volume is a report of Peter Cooper and other special commissioners, December 22, 1840, regarding the powers and duties of the water commissioners, and investigating certain complaints as to the commissioners having paid too high prices for materials and labor, from which it appears that lead cost five cents per pound, repairing the streets, twenty-five cents per square yard, labor an average of $1.08 to $1.09 per day, including foremen — $1.25 being considered wasteful.

The item of stopcocks is discussed at some length, it being shown that in one case, in 1835, in making a connection at the corner of the Bowery and Grand Street, all of the stopcocks up to the reservoir at Thirteenth Street, the number not stated, failed to shut off the water, which had finally to be shut off at the reservoir, and three days (one of them a Sunday!) pumping with a fire engine was required to free the trench; and in 1839 twenty-three stopcocks of the old kind had to be closed to shut the water off at one point. The commissioners decided to change the pattern.

The comparative merits of casting iron pipe direct at the blast furnace from the first melting of the ore and from remelted pig iron in a cupola furnace are discussed, and it is noted that the prices paid for 12-inch pipe varied from $1.60 to $1.90 per foot, with weights running from 580 to 760 pounds.

A complaint was made that 12-inch pipes were laid in certain streets in place of 6-inch, and it was answered that the department had used up all of the 6-inch pipe; and it is to be presumed that the pipe foundries' agents were not as plentiful or keen as at the present day, or that shipments were delayed.

CONTRACT AND SPECIFICATIONS FOR FURNISHING CAST-IRON WATER PIPES AND SPECIAL CASTINGS.*

NEW BEDFORD WATER WORKS.

CITY OF NEW BEDFORD, MASS.

....., 19..

TO IRON FOUNDERS.

Proposals for Coated Cast-Iron Water Pipes and Special Castings.

INFORMATION FOR BIDDERS.

Sealed bids or proposals addressed to the New Bedford Water Board, and indorsed "Proposals for Furnishing Cast-Iron Water Pipes and Special Castings," will be received at the office of the Board, City Hall, until.....o'clock ..... of .... the .....day of .....19..

All bids must be made upon the blank form of proposal annexed hereto, and should give the price for each item of the work proposed, both *in writing* and *in figures*, and be signed by the bidder, with his business address and place of residence.

All proposals containing bids not called for in this advertisement will be considered informal.

Each bid must be accompanied by a properly certified check for ..... dollars ($.....), payable to the City of New Bedford; said check to be returned to the bidder unless forfeited under the condition herein stipulated.

The amount and character of the securities for the fulfillment of the contract will be determined by the New Bedford Water Board after the proposals are opened.

If a bond is required with the contract, the sureties thereon

* Since the adoption of the Standard Specifications for Cast-Iron Pipes and Special Castings, there have been several inquiries for a form of contract for use with the standard specifications. This form shows how the requirement has been met by the New Bedford Water Works. — EDITOR.

must be residents of Massachusetts, or a reliable surety company authorized to do business in Massachusetts, and satisfactory to the Water Board.

The party to whom the contract is awarded will be required to present forthwith to the Board the names of the sureties to be offered, and to execute the contract and furnish the bond, duly executed, with satisfactory sureties, within six days (not including Sunday) from the date of the mailing of a notice from the Board to the bidder, according to the address given by him, that the contract is ready for signature, and, in case of his failure or neglect so to do, the Board may at its option determine that the bidder has abandoned the contract, and thereupon the proposal and acceptance shall be null and void, and the check accompanying the proposal shall be forfeited to the City of New Bedford.

All bids will be compared on the basis of the following estimate of quantities to be furnished:

Item.....tons.....inch pipe, Class.....
Item.....tons.....inch pipe, Class.....
Item.....tons.....inch pipe, Class.....
Item.....tons.....inch pipe, Class.....
Item.....tons.....inch pipe, Class.....
Item.....tons..... inch pipe, Class.....
Item.....tons.....inch pipe, Class.....
Item.....tons.....inch pipe, Class.....
Item.....tons of special castings.....

These quantities are considered as approximate, and the Board, therefore, expressly reserves the right of increasing or diminishing the same as in their opinion may be necessary, not exceeding twenty per cent. of the amount of straight pipes and special castings.

The Board also expressly reserves the right to reject any or all bids, should they deem it for the interests of the City of New Bedford so to do.

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.....
.....

NEW BEDFORD WATER BOARD.

.....

Superintendent.

PROPOSAL

FOR FURNISHING CAST-IRON WATER PIPE AND SPECIAL CASTINGS.

To the New Bedford Water Board:

The undersigned, as bidder, declares that the only persons or parties interested in this proposal as principals are named at the close of this document; that this proposal is made without collusion with any other person, firm, or corporation; that he has carefully examined the annexed proposed form of contract; and he proposes and agrees, if this proposal is accepted, that he will contract with the New Bedford Water Board, in the form of the copy of the Contract deposited in the office of the Superintendent, to furnish all the cast-iron water pipes and special castings specified in the contract, in the manner and time as therein prescribed, and according to the requirements of the Superintendent as therein set forth; and that he will take in full payment therefor the following sums, to wit:

Item—For all.....inch straight pipe, Class.....
the sum of.....
.....($.....) per ton of 2 000 lbs.

Item—For all.....inch straight pipe, Class.....
the sum of.....
.....($.....) per ton of 2 000 lbs.

Item—For all.....inch straight pipe, Class.....
the sum of.....
.....($.....) per ton of 2 000 lbs.

Item—For all.....inch straight pipe, Class.....
the sum of.....
.....($.....) per ton of 2 000 lbs.

Item—For all.....inch straight pipe, Class.....
the sum of.....
.....($.....) per ton of 2 000 lbs.

Item—For all.....inch straight pipe, Class.....
the sum of.....
.....($.....) per ton of 2 000 lbs.

Item—For all.....inch straight pipe, Class.....
the sum of.....
.....($.....) per ton of 2 000 lbs.

Item—For all.....inch straight pipe, Class.....
the sum of.....
.....(\$.....) per ton of 2 000 lbs.
Item—For all special castings, the sum of.....
.....(\$.....) per ton of 2 000 lbs.

If this proposal shall be accepted by the New Bedford Water Board, and the undersigned shall fail to contract as aforesaid, and, if required, should fail to provide a bond of such amount and character satisfactory to the Board, within six days (not including Sundays) from the date of the mailing of a notice from the Board to him, according to the address herewith given, that the contract is ready for signature, then the Board may, at its option, determine that the bidder has abandoned the contract, and thereupon the proposal and acceptance shall be null and void, and the certified check for.....dollars (\$.....) accompanying this proposal shall become the property of the City of New Bedford, otherwise, the accompanying check shall be returned to undersigned:

Signature of Bidder, with Residence and Business Address:

.....
.....
.....
.....
.....

Date, ...

The names and residences of all persons and parties interested in the foregoing bid, as principals, are as follows:

Notice.— Give first and last name in full, and in case of corporations give name of President, Treasurer, and Manager:

.....
.....
.....
.....
.....
.....

NEW BEDFORD WATER WORKS.

NEW BEDFORD. .....

CONTRACT AND SPECIFICATIONS FOR FURNISHING COATED CAST-IRON WATER PIPES AND SPECIAL CASTINGS.

THIS AGREEMENT, made and concluded this..... day of....., in the year one thousand nine hundred and....., between the City of New Bedford by the New Bedford Water Board, of the first part, and.....
.....
.....
of.....
in the State of....., part.....of the second part:

A. WITNESSETH, That the said Contractor has agreed, and by these presents does agree, with the said City for the consideration hereinafter mentioned, at his own proper cost and expense, to do all the work and furnish all the materials called for by this agreement, in the manner and under the conditions hereinafter specified.

B. To prevent all disputes and litigation, it is further agreed by and between the parties to this contract, that the Superintendent (meaning thereby the individual at any time holding the position or acting in the capacity of Superintendent of the New Bedford Water Board) shall be referee in all cases, to determine the amount or the quantity of the several kinds of pipes and special castings which is to be paid for under this contract, and to decide all questions which may arise relative to the fulfillment of this contract on the part of the Contractor; and his estimates and decisions shall be final and conclusive; also, that said Superintendent, by himself, or by assistants, and inspectors acting for him, shall inspect the materials to be furnished and the work to be done under this agreement, to see that the same strictly correspond with those stipulated in the specifications hereinafter set forth.

C. The parties hereto further agree that wherever in this contract the words defined below are used, they shall be understood to have the meanings herein given:

The term "Water Board" shall mean the New Bedford Water Board, or any Board or Committee duly authorized to represent the City of New Bedford in the execution of the work covered by this contract.

The words "Superintendent" or "Engineer," when not further qualified, shall mean the Superintendent of the New Bedford Water Board, or his or their properly authorized agents, limited by the particular duties intrusted to them.

The word "Contractor" shall mean the person or persons, co-partnership or corporation, who have entered into this contract as party of the second part, or his or their legal representatives.

SPECIFICATIONS.

D (1) The work to be done consists in furnishing, sound and complete in all respects, and in strict conformity with all the conditions and requirements of this contract and these specifications, the following cast-iron pipes and special castings:

.....tons of.....inch straight pipe, Class.....
.....tons of.....inch straight pipe, Class.....
.....tons of.....inch straight pipe, Class.....
.....tons of.....inch straight pipe, Class.....
.....tons of.....inch straight pipe, Class.....
.....tons of.....inch straight pipe, Class.....
.....tons of.....inch straight pipe, Class.....
.....tons of.....inch straight pipe, Class.....
.....tons of special castings, more or less, as may be required in connection with the above-described pipe, consisting of branches, bends, reducers, caps, curved pipe, sleeves, and all or any other special castings directed by the Superintendent in this connection, subject to all the conditions and requirements of this contract and specifications.

The amounts in tons of the various diameters and classes of pipes above called for are to be considered as approximate only. The Superintendent shall have the right of increasing or diminishing the amounts called for by this contract in any way, and for any reason which he may deem necessary, provided such increase or diminution does not exceed twenty per cent. of the total amount of the contract.

Where Delivered.

(2) All pipes and other castings shall be delivered.....
.....
.....
.....

(3) All castings are to be made in strict accordance with the Standard Specifications for Cast-Iron Pipe and Special Castings adopted by the New England Water Works Association, September 10, 1902. A copy of these specifications is hereto annexed, and forms a part of this contract.

Marking.

(4) In addition to the provision of Section 6, Standard Specifications for Cast-Iron Pipe and Special Castings adopted by the New England Water Works Association, September 10, 1902, each pipe and special casting shall have cast upon it the letters N. B. W. W.

How Delivered.

(5) The delivery of all pipe and special castings shall be completed on the.....day of.....
.....

Superintendent to Explain Specifications.

(6) All the work contemplated and described in this contract and specifications shall be done to the satisfaction of the Superintendent, who shall be sole judge as to the fitness of materials, and shall have the right of correcting any errors or omissions in the contract and specifications when such correction is necessary for the proper fulfillment of their intention; the action of such correction to date from the time that the Superintendent gives due notice thereof in writing.

E. On condition of the true and faithful performance of this agreement and these specifications, the said City of New Bedford agrees to pay to the said Contractor at the rate of.....
.....
for all.....inch straight pipe, Class....., per ton of 2 000 lbs.,.....

.....

for all.....inch straight pipe, Class....., per ton of 2 000 lbs.,.....

.....

for all.....inch straight pipe, Class....., per ton of 2 000 lbs.,.....

.....

for all.....inch straight pipe, Class....., per ton of 2 000 lbs.,.....

.....

for all.....inch straight pipe, Class....., per ton of 2 000 lbs.,.....

.....

for all.....inch straight pipe, Class....., per ton of 2 000 lbs.,.....

.....

for all.....inch straight pipe, Class....., per ton of 2 000 lbs.,.....

.....

for all.....inch straight pipe, Class....., per ton of 2 000 lbs.,.....

.....

.....per ton of 2 000 lbs. for the special castings.

The prices per ton above mentioned include the coating of pipes and special castings in accordance with the terms of the specifications herein named, and all labor and expenses attending the inspection, proving, and weighing at the foundry of the pipes and special castings, except the salary of the inspector. If the completion of the contract is delayed beyond the specified time, the expenses of inspection caused by such delay shall be deducted from any amount which may be due the Contractor, unless otherwise decided by the Superintendent; but this provision shall not affect any right which may accrue to the Board by reason of such delay.

F. Payments to be made on the weight of said castings received in proper order and condition, according to the certificate of the Superintendent, as soon as may be convenient under the City system of monthly audit. Provided, that nothing herein con-

tained be construed to affect the right, hereby reserved, of the said New Bedford Water Board to reject the whole or any portion of the aforesaid pipes and special castings, should the said certificate be found or known to be inconsistent with the terms of this agreement, or otherwise improperly given.

G. In order that the conditions of this contract, as regards the delivery, may not be misunderstood, it is hereby agreed that this contract may, at the option of the said Water Board, be declared and considered forfeited if, upon the.....day of.....next the Contractor shall have failed to deliver all the pipe and special castings herein enumerated, the dangers of the sea excepted. And it is mutually agreed between said parties that if said pipe and castings shall not be delivered in accordance with the terms and date herein specified, the check for..... .....dollars ($.....) hereafter referred to, deposited with said Water Board, or such portion thereof as said Water Board shall see fit to retain, shall be forfeited to said City of New Bedford; and it is further agreed that the permitting said Contractor to go on and deliver said pipes and castings, after failure to comply with the terms of delivery herein specified, shall not operate as a waiver of the rights of said Board to retain said check, or any portion thereof.

H. It is further agreed, that if, under the process of inspection, there shall have been rejected, under the conditions of this contract and specifications, during any twenty days continuously of its limitation, twenty-five per cent. of the pipes and special castings offered within that time for acceptance, the contract may, at the option of the said Water Board, be declared forfeited, and it shall be forfeited accordingly.

I. The parties hereto further agree that this contract shall be in writing and executed in duplicate, one of which duplicates shall be kept by the said New Bedford Water Board and one by the Contractor, that this contract or any part thereof or any sum due or to come due thereunder shall not be assigned or transferred without the written consent of said Water Board and shall at the election of said Water Board be utterly void as to the said city, if any person appointed to any office or employed by virtue

of any ordinance of said city, or of any Act of the Legislature relating to the supplying of water to said city, or any matter or thing connected therewith, is either directly or indirectly interested therein.

J. The said Contractor further agrees that, if required, he will execute a bond, with such sureties as shall be approved by said Water Board, conditioned to well and truly keep and perform all the terms and conditions of this contract on his part to be kept and performed, and to indemnify and save harmless the said City of New Bedford, as herein stipulated.

K. The said Contractor further agrees to deposit with said New Bedford Water Board a certified check in the amount of.....
.....dollars ($.....).
If the said Contractor shall well and truly keep and perform all the terms and conditions of the contract on his part to be kept and performed, and shall indemnify and save harmless the said City of New Bedford, as herein stipulated; then the above-mentioned check shall be returned to said Contractor; otherwise, said check shall be forfeited to the said City of New Bedford.

L. The said Contractor further agrees that the said Water Board may, if it deem it expedient to do so, retain out of any amounts due to the said Contractor sums sufficient to cover any unpaid claims of mechanics or laborers for work or labor performed under this contract; provided, that notice, in writing, of such claims, signed by the claimants, shall have been previously filed in the office of the City Clerk.

M. The said Contractor further agrees that he will indemnify and save harmless the said city from all suits or actions, of every name and description, brought against the said city for or on account of any injuries or damages received or sustained by any person or persons, by or from the said Contractor, his servants or agents, in the construction of said work, or by or in consequence of any negligence in guarding the same, or any improper materials used in its construction, or by or on account of any act or omission of the said Contractor or his agents; and the said Contractor further agrees that so much of the money due to him under and by virtue of this agreement, as shall be considered necessary by the said Water Board, may be retained by the said city until all such suits

or claims for damages as aforesaid shall have been settled, and evidence to that effect furnished to the satisfaction of the said Water Board.

N. The said Contractor further agrees that if the work to be done under this agreement shall be abandoned, or if this contract shall be assigned by the said Contractor otherwise than as herein specified, or if the conditions as to rate of progress are not fulfilled, or if at any time the Superintendent shall be of opinion, and shall so certify, in writing, to the said Water Board, that said work, or any part thereof, is unnecessarily or unreasonably delayed, or that the said Contractor is wilfully violating any of the conditions or covenants of this contract, or is fulfilling said contract in bad faith, the said Water Board shall have the power to notify the said Contractor to discontinue all work, or any part thereof, under this contract; and thereupon the said Contractor shall cease to continue said work, or such part thereof as the said Water Board may designate, and the said Water Board shall thereupon have the right to procure of other parties all or any part of the work left uncompleted by the said Contractor, and the said Contractor shall be liable in any damages caused the City of New Bedford by reason of said Contractor not completing this agreement.

O. The said Contractor further agrees that all pipes and special castings, of whatsoever description, upon which advances may have been made, shall become thereby, so far as acceptable in other respects, the exclusive property of the said city; and whatever may be found, after delivery, objectionable in castings upon which advances may have been made, the said Contractor shall make good and replace immediately on receiving notice thereof; and if said defective or objectionable castings are not replaced within thirty days after the delivery of said notice to the said Contractor at his office or place of business, the said New Bedford Water Board, as agent of the party of the first part, may then obtain from other parties, at their discretion, the castings rejected in the terms of this agreement, and the cost and expense of replacing such rejected castings by sound and unobjectionable ones shall be paid by the said Contractor or deducted from any balance due or which may become due to the said Contractor by the said city.

P. And it is also to be understood and agreed that, in case of any alterations, so much of this agreement as is not necessarily affected by such alterations shall remain in force upon the parties hereto.

Q. And it is further agreed that no payment for work done under any alteration of this contract, as aforesaid, shall be made until the completion of the whole contract.

R. And the said Contractor hereby further agrees that the payment of the final amount due under this contract, and the adjustment and payment of the bill rendered for work done in accordance with any alterations of the same, shall release the city from any and all claims or liability on account of work performed under said contract, or any alteration thereof.

S. This is to bind the representatives of the parties respectively.

IN WITNESS WHEREOF, the parties to these presents have hereunto set their hands the day and year first above written.

The City of New Bedford by the New Bedford Water Board

.....
President.
.....
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.....
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.....
.....

Signed in the presence of

.....
.....

KNOW ALL MEN BY THESE PRESENTS, That we,.....
....., as principal
.....
.....
.....
..... as suret.....
are held and firmly bound unto THE CITY OF NEW BEDFORD, in

the sum of.....dollars, lawful money of the United States of America, to be paid to the said CITY OF NEW BEDFORD, or its certain Attorney, its successors and assigns, for which payment, well and truly to be made, we bind ourselves, our heirs, executors, and administrators, jointly and severally, firmly by these presents.

Sealed with our seals, dated the..... day of.....in the year one thousand nine hundred and.....

.....

WHEREAS, The said.....

.....ha made a contract with the City of New Bedford, bearing date the..... day of.....one thousand nine hundred and .....for furnishing cast-iron water pipes and special castings.

NOW, THE CONDITION OF THIS OBLIGATION IS SUCH, That if the said.....

.....

shall well and truly keep and perform all the agreements, terms, and conditions of the said contract on..... part to be kept and performed, and shall indemnify and save harmless the said CITY OF NEW BEDFORD and said Board, against, and shall upon demand pay to the said city all damages, costs, and expenses caused by and in every way growing out of the failure of said.....

.....to keep and perform all the agreements, terms, and conditions of said contract on..... part to be kept and performed, then this obligation shall be of no effect; otherwise, it shall remain in full force and virtue.

.....[SEAL]

.....[SEAL]

.....[SEAL]

.....

Signed and sealed in presence of

.....

.....

WATER WORKS STATISTICS FOR THE YEAR 1903, IN FORM ADOPTED BY THE NEW ENGLAND WATER WORKS ASSOCIATION.

COMPILED BY CHARLES W. SHERMAN, EDITOR, JOURNAL OF THE NEW ENGLAND WATER WORKS ASSOCIATION.

The following tables contain more or less complete statistics for forty-eight water works, which have used, more or less closely, the form adopted by the Association for summarizing statistics. Some of these works report under very few of the headings of the summary.

The Editor has made no attempt to compile statistics from water-works reports which do not include at least a partial summary.

The report of the Committee on Uniform Statistics, containing the form as endorsed for use in the 1901 reports, is printed on page 51 of Vol. 15 of the JOURNAL (March, 1902). The page for Financial Statistics was changed by vote of the Association in September, 1902, as reported in the December, 1902, JOURNAL (Vol. 16, p. 263). Blank forms for use in preparing summaries are printed by the Association, and will be furnished on request.

Previous compilations of statistics may be found in the JOURNAL, as follows:

Statistics for	*Reference to Journal*
1886	Vol. I, No. 4, p. 29
1887	Vol. II, No. 4, p. 28
1888 to 1892 inclusive	Vol. VII, p. 225
1893	Vol. IX, p. 127
1894	Vol. X, p. 131
1895–96	Vol. XII, p. 273
1897–99	Vol. XV, p. 65
1900	Vol. XV, p. 367
1901	Vol. XVI, p. 223
1902	Vol. XVII, p. 235

In the various tabulations, statistics are given for the following places and years:

Place	*Year*
1. Albany, N. Y.	1900
2. Andover, Mass.	1900
3. Arlington, Mass.	1900
4. Atlantic City, N. J.	1898, 1900–03
5. Attleboro, Mass.	1894–1903
6. Bay City, Mich.	1886–87, 1893–96, 1900–03
7. Belmont, Mass.	1902–03
8. Beverly, Mass.	1903
9. Billerica, Mass.	1899–1903
10. Boston, Mass.	1886–94, 1897, 1900, 1903
11. Brockton, Mass.	1893–1903
12. Burlington, Vt.	1886–1903
13. Cambridge, Mass.	1900–03
14. Chelsea, Mass.	1900–03
15. Cleveland, Ohio	1902–03
16. Concord, N. H.	1895, 1898, 1900–03
17. Dover, N. H.	1900
18. Erie, Pa.	1900
19. Essex Junct., Vt.	1900
20. Fall River, Mass.	1886–95, 1897–1903
21. Fitchburg, Mass.	1886–92, 1894–1903
22. Freeport, Me.	1901
23. Geneva, N. Y.	1900
24. Haverhill, Mass.	1900
25. Holyoke, Mass.	1886–92, 1897–98, 1900–03
26. Hull, England	1900
27. Ipswich, Mass.	1900
28. Keene, N. H.	1899–1900, 1903
29. Lawrence, Mass.	1902–03
30. Leicester, Mass.	1900
31. Leominster, Mass.	1900
32. Lewiston, Me.	1900
33. Lowell, Mass.	1886, 1897–1903
34. Lynn, Mass.	1888–98, 1900–03
35. Madison, Wis.	1900, 1902–03
36. Manchester, N. H.	1900
37. Marlborough, Mass.	1900, 1903
38. Maynard, Mass.	1901–03
39. Metropolitan Water Works, Mass.	1900–03
40. Middleboro, Mass.	1895–1903
41. Middletown, Conn.	1902

Place	*Year*
42. Minneapolis, Minn.	1900–03
43. Nantucket, Mass.	1900
44. Nashua, N. H.	1900
45. New Bedford, Mass.	1886–1903
46. New London, Conn.	1886–1903
47. Newton, Mass.	1888–1903
48. Norwich, Conn.	1901
49. Oberlin, Ohio	1893–1903
50. Plymouth, Mass.	1886–1903
51. Providence, R. I.	1897–1903
52. Quincy, Mass.	1893, 1900–01
53. Reading, Mass.	1893, 1895–1903
54. Reading, Pa.	1901–03
55. Rochester, N. Y.	1903
56. St. John, N. B.	1902–03
57. Salem, Mass.	1900
58. Sandusky, Ohio	1886
59. Schenectady, N. Y.	1886, 1900–01
60. Somerville, Mass.	1900–03
61. Springfield, Mass.	1886–1903
62. Taunton, Mass.	1886–1903
63. Toronto, Canada	1893
64. Trenton, N. J.	1886–87
65. Troy, N. Y.	1886, 1888–93, 1897–99
66. Waltham, Mass.	1886–1903
67. Ware, Mass.	1886, 1888–92, 1900–03
68. Watertown, Mass.	1900
69. Wellesley, Mass.	1888–93, 1898–1903
70. Westerly, R. I.	1902–03
71. Whitman, Mass.	1897–1903
72. Wilmington, Del.	1900
73. Winchendon, Mass.	1900–03
74. Woburn, Mass.	1900–03
75. Woonsocket, R. I.	1886–1900, 1902–03
76. Worcester, Mass.	1900
77. Yonkers, N. Y.	1893–96, 1900–03

1903.—TABLE 1.—GENERAL AND PUMPING STATISTICS.

Number	Name of City or Town	Date of Construction of Works.	By Whom Owned	Source of Supply	Mode of Supply	1	2.—Description of Fuel Used				
						Builders of Pumping Machinery	*a* Kind	*b* Brand of Coal	*c* Av. Price per Gross Ton	*d* Per Cent. of Ash	*e* Wood. Price per Cord
1	Atlantic City, N.J.[1]	1882 1888	City.	Wells and Absecon Creek.	Pumping.	Worthington, Gordon-Max'll, d'Auria, Smith-Vaile.	Bituminous.	Standard. Eureka.	$4 10	6	...
2	Attleboro, Mass.	1873	Town.	Well near Seven Mile River.	Pumping.	Deane, Barr.	Bituminous	Georges Creek, New River.	....	..	...
3	Bay City, Mich.	1872	City.	Saginaw Bay.	Pumping.	Holly.	Bituminous.	Slack.	2 02	23	$1 85
4	Belmont, Mass.	1887	Town.	Metropolitan W.W.	. . . .	. . . . .	. . . .	. . . . .	....	..	...
5	Beverly, Mass.	1869-70	City.	Wenham Lake and Longham Res.	Pumping.	Holly.	Bituminous.	Cumberland.	5 25	12	...
6	Billerica, Mass.	1898	Town.	Driven Wells.	Pumping.	Barr.	Bituminous	Georges Creek, New River.	6 02	..	...
7	Boston, Mass.	1848	City.	Metropolitan W.W.	. . . .	. . . . .	. . . .	. . . . .	....	..	...
8	Brockton, Mass.	1880	City.	Salisbury Brook.	Pumping.	Wortht'on, Holly	. . . .	. . . . .	....	..	...
9	Burlington, Vt.	1867-8	City.	Lake Champlain.	Pumping.	Worthington.	Bituminous.	Nonpareil.	4 10	..	...
10	Cambridge, Mass.	1855	City.	Hobbs and Stony Brooks, Fresh Pd.	Pumping.	Leavitt, Worthington, Blake.	Bituminous.	Cumberland.	4 20-9 50	..	...
11	Chelsea, Mass.	1867	City.	Metropolitan W.W.	. . . .	. . . . .	. . . .	. . . . .	....	..	...
12	Cleveland, Ohio.	1856	City.	Lake Erie.	Pumping.	Worthington, Knowles, Allis, Holly, Kilby.	Bituminous	Saline ville, Slack.	1 51	..	...
13	Concord, N. H.	1872	City.	Penacook Lake.	Gravity and Pumping.	. . . . .	. . . .	. . . . .	....	..	...
14	Fall River, Mass.	1874	City.	N. Watuppa Lake.	Pumping.	Worthington, Davidson,	Bituminous	Cumberland, Georges Creek.	....	..	...
15	Fitchburg, Mass.	1873	City.	Storage Reserv'r.	Gravity.	. . . . .	. . . .	. . . . .	....	..	...

15	Fitchburg, Mass.	1873	City.	Storage Reserv'r.	Gravity.	. . . . .	. . . .	. . . . .	....	..	...
16	Holyoke, Mass.	1873	City.	Lakes, streams, and Manhan River.	Gravity.	. . . . .	. . . .	. . . . .	....	..	...
17	Keene, N. H.	1868	City.	Sylvan & Echo L'k's	Gravity	. . . . .	. . . .	. . . . .	....	..	...
18	Lawrence, Mass.	1874	City.	Merrimac River.	Pumping.	Barr, Morris.	Bituminous	Pocahontas, New River, Georges Creek.	5 66	..	...
19	Lowell, Mass.	1870	City.	Driven Wells.	Pumping.	Morris, Worthington, Deane, Knowles.	Bituminous.	. . . . .	7 86	..	...
20	Lynn, Mass.	1871	City.	Ponds and Saugus River.	Pumping.	Leavitt, Loretz.	Bituminous.	Georges Creek.	5 00	10	...
21	Madison, Wis.	1882	City.	Artesian Wells.	Pumping.	Allis, Knowles.	Anthracite.	Pea.	6 98	..	...
22	Marlboro, Mass.	1883	City.	Lake Williams and Millham Reserv'r.	Pumping.	Blake, Worthington, Barr.	Bituminous.	Various.	5 99	..	...
23	Maynard, Mass.	1889	Town.	White Pond.	Pumping.	Blake.	Bituminous.	. . . . .	4 75	6	...
						Chestnut	*Hill High*	*Service Station.*			
						Holly, Leavitt, Allis.	Bituminous	Loyal Hanna, Ocean, Quemahoning.	4 48 to 7 61	13	...
							Anthracite.	Buckwheat, Screenings.	5 75 2 24		
						Chestnut	*Hill Low*	*Service Station.*			
24	Metropolitan Water Works, Mass.	1848 1872 1895	State of Massachusetts.	Lake Cochituate, Sudbury River, Nashua River.	Pumping, 99%. Gravity, 1%.	Holly.	Bituminous	Loyal Hanna, Ocean, Quemahoning.	4 48 to 7 61	11	...
							Anthracite.	Buckwheat, Screenings.	3 36–5 75 2 24		
						Spot	*Pond*	*Station.*			
						Blake, Holly.	Bituminous	Georges Creek, Cumberland, Ocean.	5 07 to 6 16	15	...
							Anthracite.	Buckwheat, Screenings.	3 75–4 25 2 24		

[1] 13 months.

1903.—TABLE 1, *Concluded.*—GENERAL AND PUMPING STATISTICS.

Number	Name of City or Town	Date of Construction of Works	By Whom Owned	Source of Supply	Mode of Supply	1	2—Description of Fuel Used				
						Builders of Pumping Machinery	*a* Kind	*b* Brand of Coal	*c* Av. Price per Gross Ton	*d* Per Cent. of Ash	*e* Wood. Price per Cord
25	Middleboro, Mass.	1885	Fire Dist.	Well near Nemasket River.	Pumping.	Deane.	Bituminous	Pocahontas, Georges Creek, Pardee.	$3 85–6 50	..	...
26	Minneapolis, Minn.	1868	City.	Mississippi River.	Pumping.	Hardenbergh, Waters, Pray, Strothman, Worthington, Holly.	Sawdust, Edgings, etc. (also water power).	. . . . .	....[2]	..	...
27	New Bedford, Mass.	1866	City.	Quittacas Ponds.	Pumping.	Leavitt.	Bituminous.	Pocahontas.	5 62	7	$4 00
28	New London, Conn.	1872	City.	Lake Konomoc & Barns Reserv'r.	Gravity and Pumping.	. . . . .	. . . .	. . . . .	....	..	...
29	Newton, Mass.	1876	City.	Collecting gallery near Charles Riv.	Pumping.	Worthington.	Bituminous & Anthracite Screenings.	Penna., New River.	5 83	10	6 00
30	Oberlin, Ohio.	1887	Village.	East branch of Vermilion River.	Pumping.	Deane.	Bituminous.	Pocahontas.	4 00	..	...
31	Plymouth, Mass.	1855	Town.	Gt. & Little South and Lout Ponds.	Gravity and Pumping.	Worthington.	Bituminous.	Various.	5 50	..	...
32	Providence, R. I.	1870	City.	Pawtuxet River.	Pumping.	Worthington, Corliss, Holly.	Bituminous	Georges Creek, Cumb., Pocah.	5 22	10	4 50
								New River.	5 59	14	4 50
							Anthracite.	Egg, Pea, and Buckwheat.	4 37	23	4 94
33	Reading, Mass.	1890	Town.	Filter gallery.	Pumping.	Blake.	Bituminous.	Carbon, Pocahontas.	6 33	..	...
34	Reading, Pa.	1819	City.	Creeks & Springs.	Gravity and Pumping.	Worthington.	Bituminous.	. . . . .	3 29	14	3 50

34	Reading, Pa.	1819	City.	Creeks & Springs.	Pumping.						
35	Rochester, N. Y.	1873	City.	Hemlock Lake. Genesee River.[2]	Gravity. Pumping.	Holly.	Bituminous.	Pittsburg.	3 70	12	...
36	St. John, N. B. East Side. West Side.	1837 1859	City.	Little River. Spruce Lake.	Gravity and Pumping. Gravity.	....	Water Power.	.....	....	..	...
37	Somerville, Mass.	1868	City.	Metropolitan W.W.	....	.....	....	.....	....	..	...
38	Springfield, Mass.	1864	City.	Reservoirs.	Gravity.	.....	....	.....	....	..	...
39	Taunton, Mass.	1876	City.	Assawompsett and Elder's Ponds.	Pumping.	Holly, Allis.	Bituminous.	Cumberland.	5 00–8 00	..	...
40	Waltham, Mass.	1872	City.	Filter basin near Charles River.	Pumping.	Barr, Worthington.	Bituminous	Georges Creek, New River.	5 66	12	...
41	Ware, Mass.	1886	Town.	Wells.	Pumping.	Dean, Warren.	Bituminous.	.....	5 75	..	5 00
42	Wellesley, Mass.	1884	Town.	Wells.	Pumping.	Blake.	Bituminous	Puritan, Georges Creek.	5 55	12	3 50
43	Westerly, R. I.	1886	Town.	Driven Wells.	Pumping.	Worthington.	Bituminous.	Georges Creek.	....	..	...
44	Whitman, Mass.	1883	Town.	Well.	Pumping.	Blake, Worthington.	....	.....	....	..	...
45	Winchendon, Mass.	1896	Town.	Well.	Pumping.	Blake.	Bituminous.	.....	5 45	10	...
46	Woburn, Mass.	1872	City.	Filter gallery near Horn Pond.	Pumping.	Worthington, Blake.	Bituminous	Georges Creek, Carbon, New River.	5 63	9	...
47	Woonsocket, R. I.	1884	City.	Crook Fall Brook.	Pumping.	Worthington, Deane.	Bituminous.	Pocahontas.	6 20	10	3 00
48	Yonkers, N. Y.	1874	City.	Sprain and Grassy Sprain brooks and Tubular Wells.	Pumping.	Wright, Worthington.	Bituminous.	Georges Creek.	4 24 to 10 50	..	12 00

[2] Cost of sawdust, etc., averaged $6 37 per million gallons pumped. [3] Fire supply.

1903.--TABLE 1, *Concluded.*—PUMPING STATISTICS.

Number	3 Coal Consumed for the Year (Lbs.)	4 Lbs. Wood + 3 = Equivalent Coal	4a Amount of Other Fuel Used	5 Total Equivalent Coal Consumed for the Year. (3) + (4)	6 Total Pumpage for the Year in Gallons	7 Average Static Head against which Pumps Work. (Feet)	8 Average Dynamic Head against which Pumps Work (Feet)	9 Number of Gallons Pumped per Lb. of Equivalent Coal	10 Duty in Foot-pounds per 100 Pounds of Coal. No deductions	11 Cost per Million Gallons pumped into Reservoir, figured on Pumping Station Expenses	12 Cost per Million Gallons raised 1 Foot high, figured on Pumping Station Expenses
1	3 369 016 } *	4 784	...	3 373 800 } *	1 432 542 420[1] } *	95	126	425	44 618 600	$9 85	$0 078
	1 340 575 }	425	...	1 341 000 }	202 701 114[2] }	120	135	151	17 023 600[4]	29 53	0 219
2	618 229	..	...	. . . .	170 215 160	..	{ 188 / 225 }	275	53 500 000	...	...
3	4 530 600	3 000	...	4 533 600	1 104 212 781[3]	..	113	244	22 953 772	8 89	0 079
5	771 011	..	...	. . . .	405 605 118[3]	132	152	525	66 693 171	13 90	0 09
6	295 673	..	...	. . . .	29 151 887[3]	275	315	99	25 917 346	70 71	0 22
8	550 246	..	...	. . . .	539 199 314	..	...	..	. . . . .	...	...
9	. . . .	..	...	. . . .	319 463 200	289	316	..	. . . . .	31 16	0 098
10	4 462 469	500	..	4 462 969	3 160 704 360[3]	158	194	..	114 844 888	6 55	0 033
12	63 733 300	.	...	63 733 300	22 633 887 289[3]	{ 173 / 325 }	214	355	63 525 134	4 62	0 022
14	4 793 600	..	...	. . . .	1 561 339 664	..	186	326	. . . . .	14 39	...
18	{ 303 653H	..	...	303 653H	96 090 219H }	294H	322H	307H	83 530 979H	15 05	0 093H
	{ 2 177 363L	..	...	2 177 363L	938 204 252L } [2]	152L	185L	431L	66 756 094L		0 073L
19	{ 8 479 404	..	...	8 491 804	1 923 370 860	157[5]	164[5]	227	77 791 512[5]	24 03[6]	0 146[6]
	{ 3 382 437[5]	2 400[5]	...	3 384 837[5]				568[5]			
20	3 654 700	..	...	3 654 700	1 873 992 750[2]	149	150	513	73 633 725	8 42	0 006
21	1 548 100	..	...	. . . .	530 523 600[7]	201	228	..	. . . . .	...	...
22	680 000	..	...	680 000	207 874 800[3]	164	172	306	43 851 800	14 22	0 082
23	569 004	..	...	569 004	125 561 428[3]	190	212	204	39 223 177	...	...
	Chestnut Hill	*High*	*Service*	*Station*							
	a 22 253	..	...	. . . .	27 510 000 }	..	44	1 236	48 510 000 }	11 24	0 225
	b 850 524	..	...	. . . .	528 430 000 } [2]	..	120	621	71 940 000 } [3]	13 14	0 109
	c 750 153	..	...	. . . .	776 180 000 }	..	128	1 035	119 560 000 }	8 81	0 069
	d 8 177 358	..	...	. . . .	9 631 330 000 }	..	128	1 178	127 750 000 }	3 98	0 031

24	*Chestnut Hill*	*Low*	*Service*	*Station*								
	e 8 561 549	..	...	....	27 773 230 000[2]	..	38	3 244	108 380 000[3]	1 50	0 039	
	Spot Pond	*Station*										
	f 167 792	..	...	....	178 820 000	..	119	1 066	108 200 000	6 80	0 057	[2] [3]
	g 2 210 587	..	...	....	2 570 010 000	..	128	1 163	126 020 000	4 42	0 035	
25	585 840	..	...	....	90 469 000[3]	182	204	154	26 273 528	35 70	0 175	
26	....	..	33 768[8]	19 781 970	7 467 840 050[9]	..	204 to 235	..	61 713 864 to 67 481 179	10 00 to 13 81	0 042 to 0 061	
27	3 043 426	..	...	3 043 426	2 525 860 944[2]	167	188	830	129 925 914	6 20	0 033	
29	3 375 450	6 000	...	3 381 450	770 124 560[3]	234	257	228	48 815 436	18 06	0 07	
30	506 000	..	...	506 000	55 600 000[2]	80	80	110	7 173 000	35 80	0 45	
31	....	..	...	467 660	165 597 696	65	73	354	21 557 607	17 18	0 22	
32	5 358 840	167	262 975[10]	....	4 497 594 533[2]	171	177	549	80 947 800	7 44[L]	0 042[L]	
	537 900	5 500	...	543 400	335 656 058[2]	172	178	618	91 595 200	18 79[H] [4]	0 131[H] [4]	
	1 254 944	1 831	...	1 256 775	569 976 223[2]	112	128	454	48 399 300			
33	438 599	..	...	....	53 202 932[3]	219	240	121	24 302 615	73 61	0 306	
34	4 163 740	1 800	...	4 165 540	1 396 385 444[3]	213	258	335	72 130 636	7 69	0 030	
35	1 352 100[11]	0	...	1 352 000	637 321 000[2]	..	160 300	..	.....	...	...	
39	1 165 000	..	...	1 165 000	554 664 539	..	69	476	27 374 223			
	409 900	..	...	409 900	454 749 430	..	..	..	.....	14 16	0 205	
40	1 328 695	..	...	....	822 773 150[3]	164	180	624 282	95 043 181	11 07	0 062	
41	619 203	1 533	...	620 736	119 379 180[3]	221	244	192	39 136 099	22 20	0 09	
42	607 450	260	...	607 710	107 202 000	260	280	176	41 193 728	29 96	0 107	
43	1 367 310	..	...	....	246 014 500	195	210	180	29 487 000 35 915 000	25 45	0 121	
45	261 931	..	...	261 931	37 530 490[2]	246	289	168	40 330 070	29 46	0 101	
46	1 953 400	...	...	....	502 997 250[3]	200	216	258	46 386 780	18 04	0 084	
47	1 624 100	533	...	1 624 633	365 776 417[2]	238	239	225	44 893 958	16 50	0 069	
48	5 789 945	..	...	....	1 743 770 168	185	251	..	.....	16 32	...	

* 13 months.
[1] By Venturi Meter.
[2] With allowance for slip.
[3] Without allowance for slip.
[4] Water pumped twice.
[5] West Sixth Street Station.
[6] Low Service.
[7] Estimated.
[8] Cords of sawdust, etc. One cord is equivalent to 585.8 lbs. of coal.
[9] Of this, 6 522 658 950 gallons were pumped by steam power.
[10] Gallons fuel oil costing $ 0375 per gallon.
[11] Water power pumps in use most of time, but fires kept under boilers.
H High service.
L Low service.

a Engine No. 1. (Low service.)
b Engines Nos. 1 and 2.
c Engine No. 3.
d Engine No. 4.
e Engines Nos. 5, 6, and 7.
f Engine No. 8.
g Engine No. 9.

Number	Name of City or Town	Receipts						
		Balance Brought Forward		Water Rates			Municipal Departments	
		a	b	A	B	C	D	E
		From Ordinary Receipts	From Extraordinary Rec'pts	Fixture Rates	Meter Rates	Total from Consumers	For Hydrants	For Fountains
1	Atlantic City, N. J.	$—487 92	$7 307 65	. . . . .	. . . . .	$199 978 36	. . . .	. . . .
2	Attleboro, Mass.	. . . . .	3 565 84	. . . . .	. . . . .	29 087 73	. . . .	. . . .
3	Bay City, Mich.	13 459 85	. . . . .	$9 739 81	$15 482 69	25 222 50	. . . .	. . . .
4	Belmont, Mass.	5 396 95	1 051 81	. . . . .	12 553 09	12 553 09	. . . .	. . . .
5	Beverly, Mass.	. . . . .	. . . . .	34 648 61	8 372 89	43 021 50	. . . .	. . . .
6	Billerica, Mass.	. . . . .	. . . . .	1 099 94	2 340 35	3 440 29	$2 300 00	. . . .
7	Boston, Mass.	61 769 12	. . . . .	. . . . .	. . . . .	2 301 880 24	. . . .	. . . .
8	Brockton, Mass.	. . . . .	19 168 02	3 115 65	86 577 70	89 693 35	3 000 00	. . . .
9	Burlington, Vt.	. . . . .	. . . . .	7 712 09	35 487 59	43 199 68	3 540 00	$261 69[1]
10	Cambridge, Mass.	5 831 60	. . . . .	. . . . .	. . . . .	336 946 40	. . . .	. . . .
11	Chelsea, Mass.	. . . . .	. . . . .	77 000 30	23 629 86	100 630 16	2 242 80	13 50
12	Cleveland, Ohio	0	394 041 21	337 568 40	598 281 23	924 050 01	0	0
13	Concord, N. H.	. . . . .	. . . . .	35 261 59	29 617 05	64 878 64	. . . .	. . . .
14	Fall River, Mass.	93 989 03	. . . . .	3 406 15	694 00[2] 183 670 42	187 770 57	. . . .	. . . .
15	Fitchburg, Mass.	. . . . .	. . . . .	20 482 05	42 543 51	. . . . .	. . . .	. . . .
16	Holyoke, Mass.	13 985 57	. . . . .	80 411 54	24 642 34	105 053 88	. . . .	. . . .
17	Keene, N. H.	. . . . .	. . . . .	. . . . .	. . . . .	25 213 50	5 700 00	350 00
18	Lawrence, Mass.	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . .	. . . .

20	Lynn, Mass.	. . . . .	. . . . .	115 056 71	97 579 70	212 636 41	. . . .	. . . .
22	Marlboro, Mass.	1 650 04	. . . . .	11 497 20	24 041 70	35 538 90	6 760 00	. . . .
23	Maynard, Mass.	2 555 32	178 53	6 083 17	4 786 65	10 869 82	2 000 00	. . . .
25	Middleboro, Mass.	3 444 18	. . . . .	3 742 98	7 065 10	10 808 08	. . . .	. . . .
27	New Bedford, Mass.	20 584 46 12 536 98	3 178 40	81 922 00	42 202 26	124 124 26	. . . .	. . . .
28	New London, Conn.	15 602 81	. . . . .	. . . . .	. . . . .	60 607 34	11 920 00[3]	200 00[3]
29	Newton, Mass.	. . . . .	. . . . .	2 894 00	111 445 00 8 905 00[4]	123 244 00	. . . .	. . . .
30	Oberlin, Ohio	1 092 07	. . . . .	1 090 00	6 567 80	7 657 80	. . . .	. . . .
31	Plymouth, Mass.	. . . . .	—1 313 54[5]	. . . . .	. . . . .	24 550 13	. . . .	. . . .
32	Providence, R. I.	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . .	. . . .
33	Reading, Mass.	49 41 39 30	50 70	. . . . .	10 155 12	10 155 12	4 890 00	300 00
34	Reading, Pa.	55 832 69	0	129 842 27	49 726 20	179 568 47	. . . .	. . . .
35	Rochester, N. Y.	14 695 45	. . . . .	145 864 87	266 338 23	412 203 10	. . . .	. . . .
36	St. John, N. B.	3 526 05	. . . . .	. . . . .	. . . . .	112 737 67	. . . .	. . . .
37	Somerville, Mass.	. . . . .	. . . . .	163 170 84	61 164 59	224 335 43	. . . .	. . . .
38	Springfield, Mass.	10 637 38	. . . . .	153 273 49	85 399 64	238 673 13	20 000 00[3]	1 915 60[3]
39	Taunton, Mass.	. . . . .	1 961 50	. . . . .	. . . . .	63 177 66	. . . .	489 97[6]
40	Waltham, Mass.	3 465 59	4 665 23	55 645 43	13 754 71	69 400 14	. . . .	. . . .
42	Wellesley, Mass.	5 299 11	. . . . .	0	14 126 95	14 126 95	4 000 00[7]	. . .
43	Westerly, R. I.	. . . . .	. . . . .	1 977 19	24 874 79	. . . . .	825 00 2 500 00	. . . .
46	Woburn, Mass.	. . . . .	. . . . .	37 596 23	7 958 45	45 554 68	. . . .	275 00
47	Woonsocket, R. I.	. . . . .	. . . . .	2 481 78	57 652 16	60 133 94	16 675 00	2 658 25
48	Yonkers, N. Y.	14 162 22	9 814 05	. . . . .	. . . . .	136 923 19	27 270 00	. . . .

[1] Paid at meter rates, and included in Receipts — Meter Rates. [2] Fines. [3] Bookkeeping account only; no cash received. [4] Meter rents.
[5] Overdrawn. [6] For three months. [7] Includes also fountains and street watering.

1903.—TABLE 2, *Continued.*—FINANCIAL STATISTICS.

Number	Receipts—*Continued*								
	Municipal Departments—*Continued*					K	L	M	N
	F	G	H	I	J				
	For Street Watering	For Public Buildings	For Miscellaneous Uses	General Appropriation	Total from Departments	From Tax Levy	From Bond Issue	From Other Sources	Total Receipts
1	. . . .	. . . .	. . . .	. . . .	. . . .	$52 211 82	$85 000 00	$8 535 49	$352 545 40
2	. . . .	. . . .	. . . .	$4 000 00	. . . .	. . . .	31 581 00	788 49 6 67	69 029 73
3	. . . .	. . . .	. . . .	. . . .	. . . .	19 190 00	20 000 00	418 80 519 15	78 810 30
4	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	422 67	19 424 52
5	. . . .	. . . .	. . . .	27 500 00	. . . .	. . . .	. . . .	. . . .	. . . .
6	. . . .	$85 33	. . . .	. . . .	$2 385 33	1 991 97	. . . .	298 31	8 115 90
7	. . . .	. . . .	. . . .	. . . .	. . . .	21 138 34	300 000 00	1 574 000 00[a] 292 000 00[b] 74 730 69	4 625 518 39
8	$1 000 00	. . . .	. . . .	. . . .	4 000 00	. . . .	310 000 00	3 453 37	433 250 31
9	2 046 29[1]	478 80[1]	$334 13[1]	. . . .	6 660 91[2]	. . . .	. . . .	6 935 57	47 261 11
10	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	3 756 45 5 727 85	352 262 30
11	2 001 10	2 188 40	1 955 35	. . . .	8 401 15	. . . .	. . . .	. . . .	109 031 31
12	1 788 00	0	3 425 20	0	. . . .	. . . .	270 350 44	2 918 00	1 596 572 86
13	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	283 00	65 161 64
14	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	20 000 00	8 510 12	310 269 72
15	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	5 833 03	68 858 59
16	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	50 169 03	6 460 14	175 668 62
17	1 500 00	200 00	. . . .	. . . .	7 750 00	. . . .	. . . .	. . . .	32 963 50
18	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .

18	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
20	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	238 945 27	9 654 08	461 235 76
22	. . . .	223 82	. . . .	. . . .	6 983 82	. . . .	. . . .	1 949 01	46 121 77
23	. . . .	. . . .	120 00	500 00	2 620 00	. . . .	. . . .	1 132 00	17 355 67
25	. . . .	. . . .	. . . .	. . . .	1 500 00	. . . .	. . . .	208 98 341 08	16 302 32
27	. . . .	. . . .	. . . .	. . . .	12 000 00	69 180 00	. . . .	. . . .	241 604 10
28	1 500 00 [3]	700 00 [3]	. . . .	. . . .	14 320 00 [3]	. . . .	103 221 73	411 21	194 163 09
29	3 000 00	2 324 00	. . . .	. . . .	5 324 00	. . . .	32 417 20	4 950 40	165 935 60
30	. . . .	. . . .	. . . .	. . . .	. . . .	2 883 88	10 000 00	682 15	22 415 90
31	. . . .	. . . .	. . . .	. . . .	. . . .	2 000 00	20 023 33	1 703 77	46 963 69
32	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
33	500 00	. . . .	. . . .	. . . .	5 690 00	1 600 00	. . . .	284 80	17 869 33
34	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	9 040 64	244 441 80
35	. . . .	. . . .	. . . .	13 423 56 [4]	. . . .	45 500 00 55 000 00	. . . .	12 263 04 13 672 23	566 757 38
36	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	22 000 00	7 123 52	145 387 24
37	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	6 061 60	230 397 03
38	6 118 25 [3]	12 605 75 [3]	. . . .	. . . .	40 639 60 [3]	. . . .	. . . .	1 756 00 [3] 907 79	313 758 87
39	. . . .	578 13	. . . .	. . . .	1 068 10	10 000 00	. . . .	637 33 4 574 84	81 368 93
40	. . . .	. . . .	. . . .	2 031 41	. . . .	. . . .	8 000 00	4 217 93	91 780 30
42	. . . .	141 74	84 00	. . . .	4 225 74	. . . .	5 000 00	1 788 35	30 440 15
43	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	3 256 57	2 274 37 4 886 83	. . . .
46	250 00	792 00	. . . .	. . . .	1 317 00	1 031 23	1 800 00	744 53 679 06	. . . .
47	2 867 72	1 053 72	745 31	14 500 00	38 500 00	. . . .	. . . .	83 58	98 717 52
48	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	127 643 83	2 112 99	. . . .

a From sinking fund, for payment of bonds.
b Excess of income of sinking fund.

[1] Paid at meter rates, and included in Receipts — Meter Rates.

[2] Included in part in Receipts — Meter Rates.

[3] Book-keeping account only: no cash received.

[4] Frontage tax from vacant lots.

1903. — TABLE 2, *Continued.* — FINANCIAL STATISTICS.

Number	Maintenance Expenditures			DD	EE	FF	Construction Expenditures				
	AA	BB	CC				GG	HH	II	JJ	KK
	Operation	Special	Total Maintenance	Interest on Bonds	Payment of Bonds	Sinking Fund	Extension of Mains	Extension of Services	Extension of Meters	Special	Total Constr'tion
1	$59 176 32	. . . . .	. . . .	$57 643 00	. . . .	$36 211 82	$13 091 46	$5 913 98	$2 820 20	$25 168 26	$46 993 90
2	. . . .	. . . . .	$14 049 40	13 845 00	. . . .	5 200 00	. . . .	. . .	1 196 49	. . . .	29 898 40
3	16 223 09	. . . . .	16 223 09	19 190 00	$20 000 00	. . . .	11 796 70	. . .	797 50	. . . .	12 594 20
4	1 728 55	$5 701 23[1]	. . . .	1 460 00	2 250 00	520 00	4 982 45	743 43	511 91	. . . .	6 237 79
6	. . . .	. . . . .	2 715 90	3 600 00	. . . .	1 800 00	. . . .	. . . .	. . . .	. . . .	. . . .
7	827 286 89[a]	1 510 857 46[1] 2 324 04	. . . .	411 050 00	1 574 000 00	. . . .	15 487 85[b]	. . .	. . . .	. . . .	. . . .
8	24 941 42	. . . . .	. . . .	44 450 00	. . . .	. . . .	278 921 43	2 173 08	2 603 80	. . . .	283 698 31
9	30 093 67	. . . . .	. . . .	9 920 00	. . . .	. . . .	. . . .	869 31	. . . .	. . . .	. . . .
10	28 753 48	33 036 13	61 789 61	133 086 50	. . . .	121 522 50	8 429 25	2 499 90	2 212 51	15 711 79	28 853 45
11	15 599 19	32 178 83[1]	47 778 02	12 000 00	. . . .	5 410 00	1 391 15	937 65	42 34	977 85	3 348 99
12	260 092 95	. . . . .	260 092 95	131 360 00	0	0	223 253 76	0	213 755 89	407 911 66[2]	844 921 31
13	9 073 32	. . . . .	. . . .	25 050 00	. . . .	. . . .	16 840 74	2 025 21	1 023 38	. . . .	. . . .
14	. . . .	. . . . .	54 482 87	97 525 00	. . . .	. . . .	. . . .	. . .	. . . .	. . . .	20 000 00
16	. . . .	. . . . .	30 648 16	12 875 00	. . . .	26 378 06	33 479 30	. . .	62 40	55 469 87	89 011 57
17	2 398 26	. . . . .	. . . .	3 532 52	. . . .	. . . .	. . . .	. . .	. . . .	. . . .	. . . .
18	. . . .	. . . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . .	. . . .	. . . .	. . . .
20	89 588 39	. . . . .	89 588 39	91 144 95	. . . .	41 127 45	. . . .	6 212 53	. . . .	129 806 60[3]	136 019 13
22	9 019 92	. . . . .	9 019 92	21 520 00	. . . .	. . . .	. . . .	. . .	. . . .	. . . .	1 922 26

23	4 451 39	. . . . .	4 451 39	5 000 00	. . . .	. . . .	1 457 87	1 073 05	357 25	560 42	3 448 59
25	5 570 35	. . . . .	5 570 35	2 060 00	. . . .	5 500 00	11 55	178 11	. . . .	. . . .	189 66
27	76 148 46	. . . . .	76 148 46	74 180 00	30 000 00	12 000 00	34 022 11	7 078 91	2 858 40	619 95	44 579 27
28	7 908 77	. . . . .	7 908 77	21 915 00	. . . .	. . . .	5 577 35	1 407 78	705 36	51 222 61 [4]	58 913 10
29	22 606 00	. . . . .	. . . .	100 475 00	. . . .	. . . .	6 270 07	9 626 18	3 466 26	{ 15 002 00 [5] / 3 003 09	37 367 60
30	3 499 29	. . . . .	. . . .	752 50	2 000 00	. . . .	445 45	537 32	747 67	15 154 41	16 884 85
31	11 778 38	. . . . .	. . . .	4 668 90	7 640 00	. . . .	5 080 59	405 55	. . . .	14 933 75	20 419 89
32	. . . .	. . . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
33	7 609 02	. . . . .	7 609 02	8 705 00	. . . .	. . . .	62 56	1 059 56	292 38	64 88	1 479 38
34	50 430 68	1 545 24	51 975 92	16 572 00	. . . .	7 500 00	25 420 33	0	3 486 43	113 891 84	142 798 60
35	117 325 68	. . . . .	117 325 68	220 282 01	. . . .	55 000 00	34 855 80	. . .	. . . .	2 457 98	37 313 78
36	31 357 12	928 14	32 285 26	67 022 14	. . . .	12 093 64	17 263 96	. . .	. . . .	160 31	17 424 27
37	26 360 17	{ 77 288 43 [1] / 14 860 60	. . . .	5 610 00	23 000 00	. . . .	6 006 80	2 750 95	5 299 53	109 93	14 167 21
38	25 351 17	{ 15 879 74 / 211 63 / 18 157 63 }	. . .	61 000 00	. . . .	116 954 00	13 147 42	. . .	. . . .	10 686 49	23 833 91
39	29 133 23	. . . . .	. . . .	33 343 00	. . . .	2 406 86	7 496 19	3 717 18	1 203 79	1 490 67	13 907 83
40	25 371 04	. . . . .	25 371 04	17 465 00	. . . .	28 000 00	. . . .	. . .	. . . .	. . . .	10 741 36
42	6 590 48	52 02	6 642 50	11 200 00	. . . .	. . . .	5 460 71	1 087 28	207 60	. . .	6 755 59
43	11 898 56	. . . . .	. . . .	14 350 41	. . . .	2 000 00	. . . .	. . . .	. . . .	. . . .	8 929 24
46	13 995 10	. . . . .	. . . .	2 660 00	. . . .	29 929 88	1 594 30	1 671 49	. . . .	. . . .	. . . .
47	14 622 32	. . . . .	14 622 32	32 280 00	. . . .	. . . .	. . . .	. . .	. . . .	. . . .	13 875 65
48	76 518 40	. . . . .	. . . .	83 050 00	. . . .	21 000 00	. . . .	. . .	. . . .	. . . .	102 325 61

a This is an expenditure for maintenance and extensions from one appropriation: no division of it can be made under those heads.
b From loan; in addition to expenditures for extensions included in AA.

[1] Metropolitan Water Assessment.
[2] Tunnels, Pumping Station, etc.
[3] Increased storage.
[4] Barns Reservoir, etc.
[5] Water Rights.

1903.—TABLE 2, *Concluded.*—FINANCIAL STATISTICS.

Number	LL	MM Balance		N		O	P	Q	R
	Unclassified Expenses	*aa* Ordinary	*bb* Extraordinary	Total	Disposition of Balance	Net Cost of Works to Date	Bonded Debt at Date	Value of Sinking Fund	Average Rate of Interest. Per cent
1	. . . .	$85 380 97	$67 139 39	$152 520 36	. . . . .	$1 302 402 62	$1 250 500 00	$31 500 00	4 64
2	. . . .	. . . .	6 036 93	. . . . .	. . . . .	451 853 83	357 000 00	57 805 91	. . . .
3	. . . .	10 803 01	. . . .	78 810 30	City Treas.	630 907 90	342 000 00	. . . . .	5 6
4	. . . .	1 382 81	144 14	19 424 52	. . . . .	. . . . .	36 000 00	3 790 87	4 0
6	. . . .	. . . .	. . . .	8 115 90	. . . . .	92 286 31	90 000 00	9 296 71	5 0
7	. . . .	. . . .	284 512 15	4 625 518 39	Forward	16 025 824 04	8 227 000 00	7 337 902 79	4 40
8	. . . .	27 755 30	52 405 28	433 250 31	. . . . .	1 327 533 62	1 225 000 00	471 696 49	3 75
9	. . . .	6 378 13	. . . .	47 261 11	. . . . .	476 504 71	248 000 00	49 000 00[1]	4
10	$6 925 51	. . . .	. . . .	352 177 57	. . . . .	5 750 655 15	3 350 600 00	1 062 821 46	3 5 & 4
11	. . . .	40 494 30	. . . .	109 031 31	City Treas.	491 552 68	300 000 00	71 787 00	4
12	5 829 98	. . . .	354 368 62	1 596 572 86	. . . . .	9 085 086 45[2]	3 555 000 00	0	4
13	. . . .	11 148 89	. . . .	65 161 64	. . . . .	896 755 42	630 000 00	. . . . .	. . . .
14	. . . .	138 261 85	. . . .	310 269 72	. . . . .	2 010 354 46	2 080 000 00	768 669 29	4 7
15	43 032 96	25 825 63	. . . .	68 858 63	City Treas.	387 430 48	512 000 00	124 569 52	. . . .
16	5 154 37	11 601 46	. . . .	175 668 62	. . . . .	1 295 308 26	350 000 00	64 477 39	. . . .
17	. . . .	27 032 74	. . . .	32 963 50	City Treas.	. . . . .	. . . . .	. . . . .	. . . .
18	. . . .	. . . .	. . . .	. . . . .	. . . . .	2 244 872 33	752 000 00	48 620 56	5
20	. . . .	. . . .	103 355 84	461 235 76	Construction.	2 810 680 54	2 167 300 00	696 434 17	4

22	. . . .	13 659 59	. . . .	46 121 77	. . . . .	589 805 24	538 000 00	200 453 78	4
23	1 574 83	2 880 86	. . . .	17 355 67	Forward	160 000 00	125 000 00	25 000 00	4
25	. . . .	2 830 89	151 42	16 302 32	. . . . .	118 605 66	48 500 00	11 671 65	4
27	. . . .	1 517 97	3 178 40	241 604 10	Forward	3 231 340 41	1 668 000 00	240 181 79	4 36
28	30 000 00[3]	75 426 22	. . . .	194 163 09	. . . . .	952 224 88	601 000 00	. . . . .	3 59
29	. . . .	5 487 00	. . . .	165 935 60	. . . . .	2 151 974 16	2 185 000 00	1 061 179 00	4 6
30	86 26	—970 00[4]	. . . .	22 415 90	. . . . .	109 210 27	51 000 00	. . . . .	3 8
31	. . . .	. . . .	2 456 52	46 963 69	Construction	350 378 01	124 039 80	. . . . .	3 5 to 4
32	. . . .	. . . .	. . . .	. . . . .	. . . . .	6 569 925 22	6 009 000 00	1 562 158 44	3 75
33	. . . .	75 93	. . . .	17 869 33	Forward	287 833 69	216 000 00	. . . . .	4
34	940 45	24 654 83	. . . .	244 441 80	Forward	2 213 725 08	400 000 00	21 190 00	4
35	2 074 78	23 610 85	. . . .	455 607 10	. . . . .	7 822 355 23	5 610 000 00	205 000 00	3 5 to 7
36	. . . .	11 775 53	4 786 40	145 387 24	Forward	1 581 676 00	1 403 400 00	55 457 00	4
37	1 137 84	67 972 78	. . . .	230 397 03	City Treas.	815 997 35	123 000 00	. . . . .	4
38	40 554 60[5]	11 816 19	. . . .	313 758 87	Sinking Fund	2 241 904 17	875 000 00	119 657 44	4 27
39	. . . .	. . . .	2 628 01	S1 368 93	Sinking Fund and Forward	1 307 884 77	839 200 00	271 323 58	3 5 & 4
40	. . . .	4 061 10	6 141 80	91 780 30	. . . . .	626 858 20	445 000 00	189 286 50	3 88
42	950 70[6]	4 768 82	122 54	30 440 15	Forward	337 051 38	283 000 00	113 293 77	4
43	. . . .	. . . .	. . . .	. . . . .	. . . . .	363 422 37	. . . . .	47 342 08	. .
44	. . . .	. . . .	. . . .	. . . . .	. . . . .	134 412 75	100 000 00	. . . . .	4
46	. . . .	. . . .	. . . .	. . . . .	. . . . .	603 182 68	46 300 00	1 699 46	4
47	. . . .	. . . .	. . . .	. . . . .	. . . . .	273 601 96	832 000 00	116 939 53	3 8
48	. . . .	. . . .	35 132 27	180 568 40	. . . . .	1 779 310 12	1 660 000 00	373 900 69	5 33

[1] About. [2] After allowing for depreciation. [3] To City Treasury. [4] Overdrawn.
[5] Charged to city (book account) for municipal use of water. [6] To town treasury.

1903.—TABLE 3.—STATISTICS OF CONSUMPTION OF WATER.

Number	Name of City or Town	1	2	3	4	5	6	7	8	9	10	11	12
		Estimated Population						Average Consumption (Gallons per Day)				Cost of Supplying Water per Million Gallons	
		Total at Date	On Line of Pipe	Supplied at Date	Total Consumption for the Year (Gallons)	Quantity Used through Meters (Gallons)	Percentage of Consumption Metered	Total	To Each Inhabitant	To Each Consumer	To Each Tap	Figured on Total Maintenance (Item CC)	Figured on Total Maintenance+Interest on Bonds
1	Atlantic City, N. J.	36 000	35 500	150 000*a*	1 448 154 650	. . . . .	..	{ 3 967 546 { 5 656 335*a*	110 38*a*	..	842	$36 19*b*	$71 44*a*
2	Attleboro, Mass.	13 000	12 500	. . .	170 215 160	. . . . .	..	466 342	33	37	....	....	....
3	Bay City, Mich.	29 000	21 500	18 000	1 104 212 781	214 503 147	19	3 025 240	104	168	1 252	14 60	32 07
4	Belmont, Mass.	4 400	4 200	4 000	. . . . .	40 377 500	All	110 623*c*	25*c*	26*c*	172*c*	....	....
5	Beverly, Mass.	15 237	15 237	15 237	405 605 118	44 875 000	11	1 111 246	73	73	318	....	....
6	Billerica, Mass.	2 850	1 850	1 485	29 151 887	. . . . .	..	79 868	..	53	....	93 19	217 76
7	Boston, Mass.	597 900	. . .	597 900	. . . . .	6 748 022 160	..	. . . . .	..	..	....	....	....
8	Brockton, Mass.	45 500	44 000	40 000	539 199 314	299 205 468	55	1 477 258	32	37	253	....	....
9	Burlington, Vt.	19 400	18 900	18 800	319 463 200	191 253 000	59	875 241	45	46	248	....	....
10	Cambridge, Mass.	96 685	96 685	96 685	3 160 704 360	1 074 317 752	34	8 659 463	90	90	589	19 55	60 31
11	Chelsea, Mass.	34 000	34 000	34 000	. . . . .	179 587 485	..	. . . . .	..	..	....	....	....
12	Cleveland, Ohio	438 000	435 000	428 000	22 633 887 289	7 998 778 320	35	62 010 650	142	145	1 054	11 49	17 19
14	Fall River, Mass.	113 602	. . .	112 602	1 561 339 664	. . . . .	..	4 277 643	38	38	....	....	....
15	Fitchburg, Mass.	34 000	. . .	29 000	1 006 000 000*d*	. . . . .	..	2 750 000*d*	..	95*d*	....	....	....
16	Holyoke, Mass.	48 973	48 673	48 398	1 837 188 080*d*	470 267 250	..	5 033 392	103	104	1 353	....	....
17	Keene, N. H.	10 000	9 500	8 800	. . . . .	. . . . .	..	. . . . .	..	..	....	....	....
18	Lawrence, Mass.	70 000	. . .	66 500	1 034 294 471	600 979 500	58	2 833 683	41	43	437	59 65	90 67
20	Lynn, Mass.	81 000	80 000	80 000	1 875 197 646	490 000 000	25	5 137 527	63	64	365	48 00	100 00
21	Madison, Wis.	20 000	. . .	18 792	530 523 600	149 141 152	28	1 453 489	73	78	....	....	....
22	Marlboro, Mass.	14 000	13 500	12 900	207 874 800	88 077 800	42	569 520	41	44	252	43 39	146 91
23	Maynard, Mass.	5 000	3 500	. . .	. . . . .	125 000	..	350 000	70	..	500	36 40	75 61
24	Met. W. W., Mass.	900 500	. . .	. . .	39 109 120 000	. . . . .	..	107 148 000	119	..	....	....	....
25	Middleboro, Mass.	4 500*e*	4 200	3 900	90 469 000	39 156 157	43	247 860	55	63	281	61 57	84 34
26	Minneapolis, Minn.	225 000	175 000	155 000	7 467 840 050	1 844 069 125	25	20 459 835	91	132	....	....	....
27	New Bedford, Mass.	72 000	63 000	62 000	2 535 280 580	772 887 000	31	6 945 974	96	112	700	30 04	59 29
28	New London, Conn.	22 000	20 800	20 000	564 988 000	. . . . .	..	1 548 000	70	77	447	14 00	52 79
29	Newton, Mass.	37 600	36 900	36 700	769 809 852	484 000 000	63	2 109 068	56	58	290	....	159 31
30	Oberlin, Ohio	4 800	4 000	3 000	55 600 000	21 700 000	39	152 000	32	51	190	71 00	76 50
32	Providence, R. I.	202 800*f*	. . .	202 800	4 786 834 205	. . . . .	60*d*	13 114 614	65	65	562	....	....
33	Reading, Mass.	5 000	4 860	4 485	53 202 932	. . . . .	..	145 761	29	32	125	143 20	306 63
34	Reading, Pa.	86 390	86 130	86 310	3 778 588 178	1 256 943 346	33	10 324 000	120	120	570	13 76	18 14

34	Reading, Pa. . . .	86 390	86 130	86 310	3 778 388 178	1 250 545 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
35	Rochester, N. Y. .	171 000	171 000	171 000	5 618 884 175	1 832 085 000	34	15 394 118	90	90	476	20 88	60 08						
36	St. John, N. B. . .	44 743	43 099	43 099	2 621 125 200	543 861 600	21	6 414 948	143	149	1 098	12 33	37 88						
37	Somerville, Mass. .	68 000	68 000	68 000	2 120 650 000*g*	426 055 257	20	5 810 000	85	85	....	....	....						
38	Springfield, Mass. .	66 446	60 000	54 000	4 270 500 000*d*	549 780 743	13	11 700 000*d*	176*d*	216*d*	1 117*d*	....	....						
39	Taunton, Mass. . .	31 036	28 000	27 350	554 664 539	262 995 415	47	1 519 629	49	54	320	....	....						
40	Waltham, Mass. .	25 650	25 250	25 200	822 773 150	71 555 428	8	2 254 173	88	90	655	30 84	52 08						
41	Ware, Mass. . . .	8 263	7 974	7 850	119 379 180	72 351 710	62	327 066	40	42	409	....	....						
42	Wellesley, Mass. .	5 417	5 362	5 324	107 202 000	55 085 961	51	293 704	54	55	315	61 12	164 38						
43	Westerly, R. I. . .	13 500*h*	12 000	11 000	246 014 500	. . . . .	..	672 170	56	61	464	....	....						
44	Whitman, Mass. .	6 469	. . .	. . .	. . . . .	. . . . .	..	. . . .	..	..	. . .	. . .	. . .						
45	Winchendon, Mass.	5 395	3 300	2 676	37 530 490	12 765 727	34	102 823	19	31	192	72 20	168 42						
46	Woburn, Mass. . .	14 250	14 200	14 200	502 997 250	69 364 458	14	1 350 667	97	97	451	....	....						
47	Woonsocket, R. I.	35 974	35 474	35 474	365 667 963	286 190 728	78	1 001 830	28	28	392	39 98	128 26						
48	Yonkers, N. Y. . .	56 000	55 000	55 000	1 743 770 168	971 883 22_6	56	4 777 452	85	88	842	....	....						

a In summer.
b 13 months.
c Based on service meters.
d Estimated.
e Of fire district.
f Includes suburbs.
g Part measured, part estimated.
h Includes also Watch Hill and Pawcatuck,

1903. — TABLE 4. — STATISTICS RELATING TO DISTRIBUTION SYSTEM. — MAIN PIPES.

Number	Name of City or Town	1 Kind of Pipe	2 Sizes of Pipes (Inches)	3 Length Extended During the Year (Feet)	4 Length Discontinued During the Year (Feet)	5 Total Length in Use (Miles)	6 Cost of Repairs per Mile	7 Number of Leaks per Mile	8 Length of Pipe Less than 4 Ins. Diam. (Miles)	9 Hydrants: Number Added	10 Hydrants: Total in Use	11 Gates: Number Added	12 Gates: Total in Use	13 Gates: Number Smaller than 4-inch	14 Gates: Number of Blow-off Gates	15 Range of Pressure on Mains (Pounds)
1	Atlantic City, N. J.	C. I.	4–20	14 200	444	57 5	....	....	2 7	28 [1]	620 [1]	33	. . .	. . .	4	35–55
2	Attleboro, Mass.	W. I., C. I., Cem. L.	1–16	24 299	....	43 6	....	0 5	..	22	329	. . .	. . .	. . .	. . .	54–62
3	Bay City, Mich.	C. I., Wyckoff	4–20	11 747	6 805	48 2	$17 10	1 8	..	13 [1]	443 [1]	23	759	. . .	12	35–90
4	Belmont, Mass.	C. I.	4–12	3 753	....	18 7	....	0	0 5	6	147	8	233	20	11	15–100
5	Beverly, Mass.	Cem. L., C. I.	1–24	. . .	....	64 7	....	2 3	..	7	293	16	577	. . .	. . .	60–65
6	Billerica, Mass.	C. I.	6–12	. . .	....	9 7	....	1 5	..	..	101	. . .	84	. . .	4	54–120
7	Boston, Mass.	C. I.	6–48	78 910	53 572	732	....	0 3	2 1	68	7 857	150	9 446	10	. . .	25–95
8	Brockton, Mass.	W. I., Cem. L., C. I.	6–30	61 254	750	85 8	4 37	0 4	0 9	56	752	62	979	16	39	47–56
9	Burlington, Vt.	C. I., Cem. L., W. I.	4–30	1 924	460	39	3 19	0 3	4	2	216	9	661	66	14	70–85
10	Cambridge, Mass.	C. I.	2–40	1 209	....	125 4	5 05	0 0	3 2	4 [1]	1 005	14	. . .	0	. . .	45–55
11	Chelsea, Mass.	C. I.	4–16	1 650	....	38 8	....	3	0 1	5	290	7	416	0	31	50–75
12	Cleveland, Ohio	C. I.	3–48	90 631	....	594	33 76	0 4	2	150	6 858	412	12 877	6	0	20–90
13	Concord, N. H.	. . . . .	. . .	14 528	12 249	62 2	....	. . .	..	5	282	16	816	. . .	. . .	. . . .
14	Fall River, Mass.	C. I.	6–24	. . .	....	95	....	. . .	..	29	1 060	30	1 050	. . .	. . .	80
15	Fitchburg, Mass.	C. I.	2–30	5 890	....	69 1	....	. . .	..	13	529	8	581	. . .	. . .	75–55
16	Holyoke, Mass.	C. I., W. I., Ld. L.	4–30	10 686	....	85 4	2 28	0 1	5 7	2	775	18	810	15	36	45–100
17	Keene, N. H.	W. I., Cem. L., C. I.	4–24	7 712	....	40 0	2 70	1 1	3 2	8	228	5	383	. . .	31	58–63
18	Lawrence, Mass.	C. I.	1–30	9 905	2 527	83 7	....	. . .	7 6	4 [1]	604	36	1 075	0	13	65–125
20	Lynn, Mass.	Cem. L., C. I.	4–36	795	....	135	136 00	1 6	..	2	965	10	1 002	. . .	66	40–60
21	Madison, Wis.	C. I.	. . .	3 904	....	39 0	....	. . .	..	7	201	10	275	. . .	2	53–65
22	Marlboro, Mass.	C. I.	4–16	0	0	36 6	0 95	0 1	0 9	0	346	0	390	19	65	35–142
23	Maynard, Mass.	C. I.	4–12	2 150	....	9 6	0 58	0 2	..	2	92	4	89	2	2	80–95
24	Met. Water Works.	C. I., Cem. L.	6–60	11 100 [2]	....	84 2	....	. . .	..	. . .	. . .	25	353	. . .	. . .	. . . .
	Met. Water Dist., Total in cities and towns	C. I., Cem. L., Kal.	4–60	195 500 [2]	....	1 494 1	....	. . .	..	178	13 111	. . .	. . .	. . .	. . .	. . . .
25	Middleboro, Mass.	C. I.	4–12	. . .	....	17 3	....	0	0	..	121	. . .	178	0	6	40–60
26	Minneapolis, Minn.	C. I., W. I., Steel	6–50	41 503	83	286 6	....	0 3	..	71	3 412	87	2 452	. . .	45	. . . .
27	New Bedford, Mass.	C. I.	4–36	13 553	1 811	100 1	10 36	0 2	0 9	19	998	40	1 172	114	99	25–95
28	New London, Conn.	Cem. L., C. I.	4–24	9 425	0	59 8	6 09	2	16 1	4	332	11	377	. . .	34	35–45
29	Newton, Mass.	C. I.	4–20	2 520	0	139 3	1 50	0	3	3	966	4	819	48	394	80–86
30	Oberlin, Ohio	C. I.	4–12	532	....	10 5	0	0	0 3	1	97	1	67	2	2	27–32

31	Plymouth, Mass.	W. I., Cem. L.	2–20	5 935	4 654	45 8	10 90	1 2	10 2	6	193	10	471	136	37	. . . . .
32	Providence, R. I.[3]	C. I.	6–36	30 315	2 634	341 4	. . . .	0 1	0	29[1]	1 989[1]	76	3 606[3]	0	32	64–73
33	Reading, Mass.	C. I.	6–12	. . .	. . . .	28 5	1 82	0	0	0	163	0	248	0	14	63–78
34	Reading, Pa.	C. I.	1½–36	16 578	3 694	105 2	29 38	0 9	0 8	22[1]	840[1]	73	2 530	10	. . .	10–133[1]
35	Rochester, N. Y.	C. I.	4–36	27 436	10 179	299 4	27 40	0 1	9 5	95	3 049	85	3 263	313	80	30–95 65–140[4]
36	St. John, N. B.	C. I., W. I., Cem. L.	1½–20	7 401	. . . .	50 7	6 54	0 4	1 9	12	404	21	1 216	126	133	10–75
37	Somerville, Mass.	C. I.	4–20	3 280	. . . .	88 4	3 79	0 1	. .	19	1 018	36	1 319	. . .	132	35–100
38	Springfield, Mass.	Cem. L., W. I., C. I.	1–36	17 289	916	150 4	4 98	0 3	8	28[1]	1 000[1]	70	2 053	416	89	100–120 H. S. 30–35 L. S.
39	Taunton, Mass.	C. I.	4–30	3 690	. . . .	80 6	. . . .	0 3	1 5	10	813	9	579	12	60	45
40	Waltham, Mass.	C. I., Cem. L.	2–24	4 993	2 512	52 5	2 67	1	2 11	14	364	6	717	40	60	50–70
41	Ware, Mass.	C. I.	4–12	1 921	. . . .	12 5	. . . .	. . .	1	3	120	3	126	12	3	90–95
42	Wellesley, Mass.	Cem. L.	4–12	4 344	. . . .	31 3	0 40	5	0 2	5	290	6	234	3	4	70–75
43	Westerly, R. I.	C. I.	4–12	1 231	. . . .	32 3	. . . .	0 2	. .	4	153	16	201	. . .	7	82–92
44	Whitman, Mass.	C. I., Cem. L.	. . .	. . .	. . . .	17 7	. . . .	. . .	. .	. .	159	. . .	. . .	. . .	. . .	65
45	Winchendon, Mass.	C. I., W. I.	2–14	2 884	. . . .	17 8	. . . .	. . .	1 8	5	139	4	184	31	17	40–151
46	Woburn, Mass.	C. I., Cem. L.	4–14	2 047	. . . .	54 8	14 64	0 6	5 3	3	361	2	428	53	17	70–75
47	Woonsocket, R. I.	C. I.	4–20	4 952	. . . .	49 0	2 19	0 1	0	9	580	10	485	0	15	50–120
48	Yonkers, N. Y.	C. I.	3–30	12 408	. . . .	91 2	10 54	1 3	0 8	28	937	22	605	3	24	45–130

[1] Public hydrants only. [2] After deducting length abandoned. [3] Not including high pressure fire system. [4] Fire service.

1903.—TABLE 5.—STATISTICS RELATING TO DISTRIBUTION SYSTEM.—SERVICE PIPES.

Number	Name of City or Town	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		SERVICE PIPE					SERVICE TAPS				METERS				Motors & Elevators	
		Kind	Sizes (Inches)	Extended (Feet)	Discontinued (Feet)	Total in Use (Miles)	Number Added	Total in Use	Average Length of Services (Ft.)	Average Cost of Services for the Year	Number Added	Now in Use	Percentage of Services Metered	Percentage of Receipts from Metered Water (B) ÷ (C)	Added	Total in Use
1	Atlantic City, N. J.	Tin Lined Galv. Iron.	½–4	2 287	...	...	165	4 636	13 9	$20 60	133	3 943	84	..	..	0
2	Attleboro, Mass.	...	...	....	...	...	...	....	....	.....	118	1 567	..	..	..	2
3	Bay City, Mich.	Lead, W. I., C. I.	⅜–8	....	...	...	90	2 408	....	....	77	1 015	42	61	..	..
4	Belmont, Mass.	W. I., Cem. Lined.	1	1 451	0	6 3	22	643	66	33 79	22	643	100	100	..	..
5	Beverly, Mass.	Galv. I., Lead Lined.	¾–4	....	...	...	66	3 485	38	....	14	111	3	19	..	..
6	Billerica, Mass.	W. I., Cem. Lined.	1–1½	1 486	...	3 2	17	256	73	....	19	142	55	68	..	..
7	Boston, Mass.	Lead, C. I.	⅝–6	26 348	6 696	471 7	676	90 013	28	....	100	4 727	5	..	11	718
8	Brockton, Mass.	W. I., Ld. L., Cem. L., C. I.	¾–8	11 377	187	38 4	179	5 849	62 25	11 94	195	5 299	91	92	2	10
9	Burlington, Vt.	Galv. I., C. I., Lead.	½–6	1 820	260	19 1	60	3 524	26	8 81	153	2 680	76	82	0	35
10	Cambridge, Mass.	Galv. I., C. I.	¾–8	5 333	...	114 2	123	14 692	45	17 51	237	2 326	15	..	..	..
11	Chelsea, Mass.	Lead.	⅝–2	1 694	...	31 9	59	6 257	28	15 89	6	113	2	22	0	6
12	Cleveland, Ohio	Lead, Galv. I.	¾–4	....	...	...	2 777	58 852	....	....	13 931	25 030	43	65	..	154[1]
13	Concord, N. H.	...	..	1 256	...	15 0	45	3 376	....	....	69	1 272	38	46	..	..
14	Fall River, Mass.	Lead.	½–2	....	...	...	220	7 502	....	....	238	7 211	96	98	..	..
15	Fitchburg, Mass.	W. I., Cem. L., C. I.	¾–8	....	...	...	70	4 693	....	....	118	2 712	58	..	6	107
16	Holyoke, Mass.	Cem., Rubber L., Enam., C. I., Ld. L., Galv. I.	½–4	800	12	14	40	3 719	20	15 01	4	247	7	23	8	106
17	Keene, N. H.	W. I., Cem. L., Galv. I. Lead.	¾–6	1 750	...	10 9	35	1 859	....	....	1	106	6	..	..	10
18	Lawrence, Mass.	G. I., Lead, Lead L., C. I.	¾–10	5 772	1 308	50 1	131	6 483	41	24 24	279	5 603	86	90	2	11
20	Lynn, Mass.	Cem. L., Lead L.	½–4	11 609	418	100	231	12 998	40	18 00	265	3 538	25	23	..	7
21	Madison, Wis.	Lead.	⅝–1¼	3 503	...	16 5	185	3 317	....	....	193	3 176	96	..	..	..
22	Marlboro, Mass.	Cem. L., Ld. L., Lead, Galv. I.	¾–2	201	93	9 2	10	2 258	21	12 08	50	1 266	56	67	..	11
23	Maynard, Mass.	Cem. L., Lead Lined.	¾–1	2 880	...	...	72	608	40	6 00	30	115	19	..	0	1

24	Met. Water Dist. Total in cities and towns	. . . . .	..	....	....	....	2 914	144 518	....	....	1 291	14 364	10	..	..	..
25	Middleboro, Mass. .	Cem. Ld., W. I., Lead	1–2	388	0	9 7	10	867	58	....	18	389	45	65	0	7
26	Minneapolis, Minn. .	Lead, Galv. I.	$\frac{5}{8}$–1	....	....	....	....	23 276	....	....	1 429	9 217	40	..	0	8
27	New Bedford, Mass.	Lead, C. I.	$\frac{1}{2}$–10	11 737	547	64 8	315	9 927	35	21 07 7 58	183	1 954	20	34	4	132
28	New London, Conn.	Cem. L., Galv. I., Lead	$\frac{1}{2}$–4	2 016	71	10 7	109	3 463	19	10 25	14	278	8	..	1	6
29	Newton, Mass. . . .	Galv. I., Tarred I., Ld.	$\frac{1}{2}$–6	10 630	3 413	81 8	92	7 404	78	25 02	122	6 367	86	98	0	17
30	Oberlin, Ohio . . .	Galv. I., Lead	$\frac{3}{4}$–4	....	....	....	68	800	25	9 00	48	512	73	86	0	0
31	Plymouth, Mass. . .	Lead, Cem. Lined	$\frac{1}{2}$–4	616	....	6 3	67	2 110	9	6 05	....	....	..	..	0	1
32	Providence, R. I. .	Lead, C. I.	$\frac{1}{2}$–10	....	....	....	579	23 332	....	....	622	19 838	85	..	7	176
33	Reading, Mass. . .	C. I., Cem. L., Ld. L.	$\frac{3}{4}$–6	1 598	....	15 4	26	1 162	73	40 74	17	1 035	89	100	1	4
34	Reading, Pa. . . .	Lead, W. I., C. I., Ld. Lined	$\frac{1}{2}$–8	....	..	....	501	18 104	....	....	185	1 137	6	28	1	10
35	Rochester, N. Y. . .	Ld., Comp., W. I., C. I.	$\frac{3}{8}$–8	....	....	....	542	36 426	16	13 00	891	11 201	35	65	0	57
36	St. John, N. B. . .	Ld., W. I., Cem. L.	$\frac{1}{2}$–4	2 964	....	32 0	110	5 845	27	17 89	5	200	3	..	0	12
37	Somerville, Mass. .	Ld., Ld. L., Cem. Ld.	$\frac{1}{2}$–6	5 529	....	69 3	144	10 854	....	19 10	369	638	6	27	0	9
38	Springfield, Mass.	Lead, Cem. L., Tarred, Galv. I., C. I.	$\frac{1}{2}$–6	....	....	....	250	10 471	....	....	261	3 789	36	36	18	280
39	Taunton, Mass. . .	Cem. L., Tin Lined.	$\frac{3}{4}$–3	3 960	7 457	46 2	82	4 753	....	33 57 46 46	84	2 134	45	..	..	17
40	Waltham, Mass. . .	W. I., C. I.	$\frac{3}{4}$–12	8 131	3 536	42 1	47	3 440	62	28 15	100	300	9	20	4	10
41	Ware, Mass.	W. I., Cem. Lined.	1–2	799	....	9 9	20	799	62	....	22	800	94	..	1	10
42	Wellesley, Mass. . .	C. I., Cem. L., W. I., Lead Lined.	$\frac{1}{2}$–6	4 560	363	16 1	28	916	117	14 75	30	911	100	100	0	0
43	Westerly, R. I. . .	Lead, W. I.	$\frac{1}{2}$–4	....	....	....	74	1 449	....	15 23	94	1 182	82	..	0	11
44	Whitman, Mass. . .	. . . . .	..	....	....	....	....	1 058	....	....	....	....	..	..	..	..
45	Winchendon, Mass. .	W. I.	1–2	1 605	....	4 6	33	536	46	13 95	39	516	95	99	0	0
46	Woburn, Mass. . .	Ld. L., Cem. L.	1	....	....	....	34	2 996	....	29 18	1	65	2	18	..	9
47	Woonsocket, R. I. .	Lead, C. I.	$\frac{5}{8}$–6	2 171	....	7 4	116	2 557	17	16 65	90	2 208	86	96	0	13
48	Yonkers, N. Y. . .	Lead, C. I.	$\frac{3}{8}$–8	....	....	....	180	5 675	....	....	240	5 804	100	..	3	11

[1] Elevators only: number of motors unknown.

UP TO 1895 — SOME REMINISCENCES.

BY R. C. P. COGGESHALL, SUPERINTENDENT NEW BEDFORD WATER WORKS.

[*Read September 14, 1904.*]

It was my privilege, two years since, to present to you an historical sketch treating of the beginning and early days of this Association.* Grouped around the historical facts there enumerated were woven a series of reminiscences with the idea of giving color and added interest. The object of that paper was threefold:

1. To place before you a clear and authentic statement of the conditions under which the Association was organized.

2. To emphasize the credit due that little band of modest but earnest workers who so securely constructed the foundation upon which the superstructure of our society now rests, and made the act of organization on June 21, 1882, a possibility.

3. To place upon the records of this Association all facts connected with the organization period in such a way as to completely disarm future controversy as to the acts of those days.

I do not wish to be understood as hinting that there had ever been any important controversy over these matters, but twenty years witness many changes in an Association of this character. Few of the original number remain in active touch with its affairs at the end of such a space of time. It, therefore, is not strange that a majority of the present membership know little concerning our early life.

Previous to presenting my former paper, there had been many misstatements made in public concerning these matters, and, I am sorry to add, by those who ought to have known better. Claims regarding our origin widely at variance with the real facts had been made. Even our birthplace was claimed by more than one locality.

* "Twenty Years After — A Retrospect." — Journal of the N. E. Water Works Association, December, 1902, Vol. XVI, p. 271.

Such was the condition when one day, a few years since, the president of the Salem Water Board, in welcoming the members of the Association to a banquet in that city, made the astonishing statement that it was fitting that we should again return to the scene of our birth, that event having occurred at the pumping station of that city at Wenham Lake.

Our Salem friend was undoubtedly innocent enough in his statement. He did not know himself. Somebody had told him so. That somebody's imagination had added the item of birth to the actual fact of a visit to the Salem pumping station several months after the organization of this Association in Boston.

After hearing of so many places where we had come into existence, some of the " old guard " members began to feel, with " Topsy," that we never were born. I can sympathize with our " Martin Luther " friends of Lowell in the pleasure of celebrating the birthday anniversary of an illustrious leader twice a month, or more frequently if one finds himself in proper spirit so to do, but when it comes to location of birth, most of us prefer to know that it occurred once only at some well-defined place.

In the minds of many of our older members it seemed as if better information regarding our early days was sadly needed. My former paper was an attempt to supply that need. How well it accomplished its mission is for others to judge. But it appeared to meet your favor, if the many solicitations for a continuation of those reminiscences is any index. In the supplementary series on which I am now about to enter, I have no such prominent object in mind as was the case in the former paper. Consequently, what I now have to say may fail to appeal to you as favorably as did the former address.

My former paper treated of the period commencing with our early days, and concluding with the New Bedford Convention in June, 1886. Henry W. Rogers, then superintendent at Lawrence, had just been installed as president. Albert S. Glover and Edwin Darling were continued in their respective positions as secretary and treasurer.

Henry W. Rogers * possessed a type of manhood that we do well to honor. Scrupulously honest and unusually clearheaded

* A portrait of Mr. Rogers accompanies the earlier article.

and well equipped in his chosen work, he commanded the respect and regard of every one who came in contact with him. He knew his business thoroughly. He possessed a sensitive nature, was easily upset by political interference, and was naturally very shy and retiring; so he was apt to remain very quiet at our gatherings unless his opinion was sought. His clear statements were always valued, for they were filled with common sense. This Association never possessed a more loyal and interested member than Henry W. Rogers. During the latter part of his presidency he resigned his position as superintendent of the Lawrence Water Works, and became agent for Maxcy & Lewis, of Maine, then well-known contractors for various water construction projects. His work located him for some time at Calais, Me.

He relinquished his connection with Maxcy & Lewis in 1889, becoming superintendent at Salem, Mass. In 1891 he accepted the superintendency at Milford, Mass. The following year we find him superintendent at Haverhill, Mass., which position he continued to fill until 1898. He then established a small coal business at Roxbury, Mass., which he soon relinquished on account of failing health. He returned to Haverhill in 1899, and died in that city in April, 1901.

An important item to chronicle in connection with Mr. Rogers' administration was the appearance of the first issue of the present quarterly JOURNAL of this Association, in September, 1886. At the previous June convention the Association had decided to establish this publication, and had elected W. R. Billings, then superintendent at Taunton, and the writer, as editors. This publication has since continued to appear with the close of each quarter. Neither editor possessed previous experience with the work which he undertook. But that did not matter. Both took hold with a hearty good-will and a determination that the experiment should not fail for want of push. Being located only twenty miles apart, it was easy to have frequent meetings. We gave much study to the general typographical appearance of the publication. I feel that we did well, for the general style then adopted has remained with little change up to the present time. It was not an easy matter to find material for each number in those days. I had quite a number of interviews with Prof.

W. S. Chaplin, then at the head of the Lawrence Scientific School of Harvard University, before I could persuade him to contribute his paper, entitled " Water in Japan," which appeared in the second issue. I had a similar experience in obtaining from T. M. Stetson, Esq., a noted lawyer in my city, his argument in favor of a Fall River Water Act, which appears in the June, 1887, issue. So we got along somehow, and the way gradually appeared easier, for the publication soon began to attract attention outside the ranks of the Association.

At the invitation of President Rogers, the September field day meeting of 1886 was held at Lawrence, Mass. It consisted of a reception, light lunch, visit to the Pacific Mills, the water works pumping station, display of fire department, banquet, speeches, and benediction. One incident occurred in connection with the visit to the Pacific Mills which I do not recall as having been heretofore told. Just as the party was about to start from the city hall for the mill, Mr. Parker, one of the superintendents of that corporation, came to me and told me that he was very much disturbed at the receipt of a message announcing that a certain Mr. —— would probably be in our party. This individual was a well-known expert connected with a rival corporation, and his presence would not be agreeable upon the floors of the Pacific Mills. We failed to locate any one answering the description furnished by Mr. Parker. So we had a dummy telegram prepared addressed to the individual in question. Just as the party was about to enter the mill, I jumped upon the steps, held up the telegram, and called out the name. No one responded. We soon learned from some of our members that the individual in question had not arrived. Whereupon the mill officials felt decidedly more comfortable.

The following December the quarterly meeting was held at the Quincy House, Boston. This, and a meeting held in January at Young's Hotel, were mainly devoted to matters of experience. In February, 1887, Hiram F. Mills, C.E., a member of the then newly organized State Board of Health, gave an outline of work upon which that organization was about to enter. He dwelt in detail upon those matters having special interest for the members of this Association. That was the beginning. We can now tes-

tify our appreciation of the admirable work which has since been accomplished by this board. At the same meeting, Prof. George F. Swain made his bow to the Association, presenting an able paper upon the "Influence of Forests upon Rainfall." The following month, March, 1887, saw the quarterly meeting at which Albert F. Noyes, then city engineer at Newton, gave his paper on "The Driven Well System as a Source of or a Means of Obtaining a Water Supply." This paper attracted considerable attention.

The sixth annual convention occurred at Manchester, N. H., on June 15, 16, and 17, 1887. President Rogers was unavoidably prevented from attending this convention, and he sent word at the last minute. Secretary Glover had great difficulty in inducing a vice-president to act as presiding officer. He went down the list, and one after another asked to be excused, until he came to Willard Kent, our present accomplished secretary. He kindly consented to help out as best he could. He filled the position with credit to himself, and to the great satisfaction of all present. In the long list of those elected to membership at this time, I note the following well-known names: Rudolph Hering, Frederic P. Stearns, W. E. McClintock, Prof. George F. Swain, George A. Kimball, J. J. R. Croes, Louis H. Knapp, Prof. Albert R. Leeds. There were several interesting papers presented, and a number of topical discussions followed. Among the most important papers presented was one on "Mixing and Handling of Concrete at Ashland Basin No. 4," by Wilbur F. Learned, and another on the "Aëration and Filtration of Water," by the late Charles B. Brush, C.E., of Hoboken, N. J. A brilliant discussion by Prof. Albert R. Leeds of the Stevens Institute at Hoboken followed the presentation of the last-named paper. He had a fine platform presence, a ready flow of language, and an interesting and attractive method of presenting his subject. Consequently he commanded the attention of all his listeners. Both Mr. Brush and Professor Leeds were earnest workers, but their work in this world has since been closed by the icy touch of death.

Jason Giles was then the Manager of the Chapman Valve Manufacturing Company. He was very popular. During a discussion upon the subject of "Hydrants" at this convention, he was

invited to speak. He did so, showing so much tact that he was roundly applauded when he finished.

The subject of hotel accommodations has always been and still remains a fruitful source of criticism. Conventions seldom occur where every one is wholly satisfied. In the majority of conventions a large amount of fault-finding is in evidence from this cause. There is no question that the enthusiasm of many of our early attendants was dampened by unsatisfactory hotel service. Right here I am going to relate an instance which occurred at this Manchester convention. The hotel selected for headquarters lacked capacity. We were crowded in all sorts of ways. A number of the older members occupied cots set up at night in the room reserved for the secretary's office. Others doubled up in rooms as best they could. Among the company was George H. Frost, President of the Engineering News Publishing Company of New York. He shared a room with others. They did not agree as to the proper use of the room. Frost went to his room at night for the purpose of wooing the sleepy god. Some of his comrades were not inclined that way. At a late, or rather early, hour there occurred an incident which rendered sleep impossible for the remainder of the night on the part of Frost. When he appeared in the morning, he was filled with righteous indignation. A person of his quiet taste could hardly be expected to be in sympathy with the treatment which he received from his roommate. His interest in the convention vanished, and he immediately left for home. I think that he has never appeared at any of our meetings since. Previous to that time he had taken a great personal interest in our affairs, both by attendance at our meetings and by helpful service in many other ways. In appreciation of all this, the Association had elected him an honorary member at the New Bedford convention the previous year. He must have had an enjoyable time at that gathering, for evidence of which note the following extract from an editorial which appeared in the *Engineering News* of June 26, 1886:

"It is quite impossible for a superintendent of water works to theorize on the advantages of attending a convention such as this while seated comfortably in his office a day's journey distant, or busily engaged in superintending actual work in his department. Reading the published reports in a newspaper

or in the transactions of the Society is but a partial substitute for actual attendance. One must meet in person his fellow experts, see what kind of men they are, engage in conversation at the meetings and elsewhere, catch the opinions that never reach the stenographer or newspaper reporters, visit the points of interest, see the numerous appliances on exhibition that are never described in the reports, make the acquaintance of the manufacturers and their agents who are in attendance, enjoy the good fellowship that abounds, and in general obtain the benefits of a delightful outing in company with a select band of kindred spirits.

"All this and more made the convention at New Bedford a pleasant three days' vacation; the expense was trifling, the benefits immense in comparison; the city government and water commissioners were assiduous in their efforts to entertain the visitors, and they succeeded admirably; while the indefatigable president and secretary of the Association managed to keep everything in the smoothest of running order, — after the example of the excellent machinery at the pumping station, under the control of the president, — so that nothing was lacking to render the meeting a genuine success, viewed either as an intellectual tournament or a social gathering."

In contrast to this, let me present the following from the editorial column of the same publication of June 25, 1887, shortly after the experience heretofore related regarding the Manchester convention:

"The next annual meeting will be held at Providence, R. I. It is a satisfaction to note this action on the part of the Association. The hotel accommodations at Manchester were most unsatisfactory, and it has been abundantly demonstrated that the average New England hotel in cities of the size of Manchester cannot provide for an immediate inroad of one hundred and twenty-five extra guests, so it was considered advisable to seek accommodations in the larger city. There is no doubt that good food, well served, and, above all, a comfortable bed to spend the night in, are important elements to the success of any gathering such as these conventions are. If men come to the meetings weary in body and mind, hungry and sleepy, they cannot be expected to feel much enthusiasm over the subject in hand. It is simply the national disposition that allows the average American to submit to the regular imposition of the average innkeeper. Americans are the most patient and submissive people in the world; if there is any part of America where good hotels should be the rule and not the exception, it is in New England, and it is the duty, an absolute obligation of a body of men such as met in Manchester last week, to express their feelings of dissatisfaction where they are not properly treated."

The hotel accommodations at Manchester were fully as good as they were the previous year at New Bedford. That in my

own city I know to be inadequate to satisfactorily cater for one of our three days' conventions. Without doubt there were many at New Bedford who suffered from poor service. But our friend did not happen to be one of that number. On the contrary, he appears to have been well cared for on that occasion.

When it is possible to provide attractive and comfortable service, it is indeed a pleasure to have the convention of this Association meet at our respective home cities. But the city or town that lacks proper hotel accommodations had better refrain from urging such a gathering to assemble within its borders, rather than to risk the result that many may return to their homes dissatisfied with the hotel treatment they have experienced. There are really very few cities in New England to-day that contain hotel equipments adequate for such an occasion as our three days' convention.

At the close of this convention Edwin Darling became president; R. C. P. Coggeshall, secretary; Albert S. Glover, treasurer; Prof. George F. Swain, senior editor; William R. Billings, junior editor. The Association had now reached a degree of prosperity where it was decided to allow a salary of three hundred dollars and traveling expenses to its secretary.

The last day of this convention was devoted to a program of entertainment prepared by Manchester friends. The day was perfect and the program went off without a hitch. In the morning we took a drive through different parts of the city, stopping first at Superintendent Walker's comfortable "old Colonial" home, when under the spreading elms we partook of refreshments, which afterwards were washed down with Massabesic water artistically combined with something attractive to the palate, and which caused the stock on hand to disappear like dew before the morning sun. Then a little later another stop was made at Commissioner Chandler's home, when a similar program was indulged in. We then proceeded to the train for Lake Massabesic, the source of the water supply of the city of Manchester. Arriving, the pilgrims were conveyed across a short arm of the lake by a funny little steamer named *Joe Cobb* to Fletcher's Island, where a shore dinner was served, followed by speech-making and amusements of various sorts.

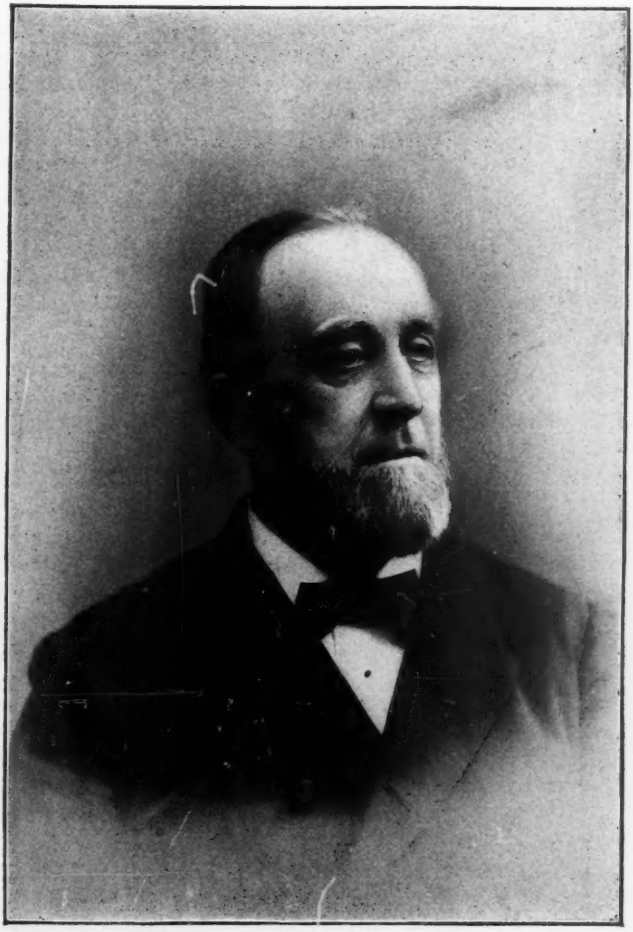
There were several ex-governors of New Hampshire in the party that day. One of them remarked that he felt certain that the New England Water Works Association was an excellent institution to prevent scarcity of water supplies, for he had seen them on many occasions and noticed that they always tasted it, but finding it an old acquaintance, they endorsed it, saying that it was very good, and then passed to try the next. John Hosley, then mayor of Manchester, was in evidence everywhere that day. So was the water registrar, Walter E. Stearns, who did much personal work during the entire convention in enhancing the personal comfort of the visitors.

Edwin Darling was president of this Association from June, 1887, to June, 1888. He possessed a tremendous energy, indomitable will, and vigorous but narrow intellect. He had many of the qualities of good leadership. He had very positive opinions upon all matters, and was extremely fond of having his own way. There was nothing bashful in his makeup. If he wanted an office he frankly said so, and asked you to support him: witness his effort for election to the presidency of this Association for a second term, in June, 1888. But, withal, he was an extremely kindhearted man, and no one ever wanted to be upon the popular side more than he. Of his integrity and honesty there is no question. He felt that he was the natural leader of the Association, and as long as he could maintain a prominent position in our affairs his interest continued; but a few years later, when his influence waned, he resigned his membership. He lived only a few months after leaving this Association.

The September meeting of 1887 occurred upon the steamer *Mt. Washington*, on Lake Winnepesaukee. All that was done was to add a few names to our membership roll.

Commencing with the following December, there occurred four successive monthly meetings at Young's Hotel, Boston. Among notable papers presented at this period were those by Prof. T. M. Drown on " Odor and Color of Surface Waters," and by Prof. W. T. Sedgwick on " The Biological Examination of Water." Among well-known names added to our membership roll at this period appear those of George E. Evans, R. A. Hale, and the late Charles H. Swan.

PLATE I.



EDWIN DARLING
President of the New England Water Works Association
1887-88

The Providence convention occurred June 13, 14, and 15, 1888. The headquarters of the Association were at the Narragansett Hotel. The sessions were held at the Veteran Fireman Association Hall. The hotel arrangements were a decided advance, viewed from the point of comfort, over anything we had heretofore experienced. But, as I look back, it seems to me that this convention was the most uninteresting of any I ever attended. The very oppressive weather which came at this time probably contributed to the lack of inspiration evident on every hand. Then I have felt that the program was not as attractive as it might easily have been made. Some of the members were so affected that they left for home before the close. I was in a gloomy state of mind, and well remember the help given me by a talk with our always "level-headed" friend, Charles K. Walker, in the hotel lobby at the close of the last session. Among those who joined the Association at this time were Thomas M. Drown, J. Herbert Shedd, George F. Chace, J. A. Gould, and Charles E. Bolling. Among the papers presented were "Tubular Wells," by the late W. C. Boyce; "Soils from which Water Supplies may be Drawn by Filter Galleries," by the late Phinehas Ball; "Aëration" and "Relief Valves," by S. E. Babcock; "Covered Reservoirs," by the late Charles H. Swan; "Testing of Water Meters," by L. Frederick Rice, and a lecture illustrated by lantern slides upon the method of building the new Croton aqueduct, by Prof. J. E. Denton, of Hoboken, N. J. The concluding feature of this convention was an excursion down Providence River upon the last day, with a landing at Crescent Park, where the party partook of a shore dinner.

Hiram Nevons, of Cambridge, became president at the close of this convention; R. C. P. Coggeshall was reëlected secretary; Albert S. Glover was reëlected treasurer; Prof. George F. Swain was elected senior editor; and Walter H. Richards, junior editor.

Hiram Nevons, the seventh president of this Association, was then the superintendent of the Cambridge Water Works. He was a man of good executive ability. He was tender and sympathetic in all the relations of life. Strong in his personal attachments, he possessed a cheerful and welcome presence, which impressed every one who came in contact with him. Having a

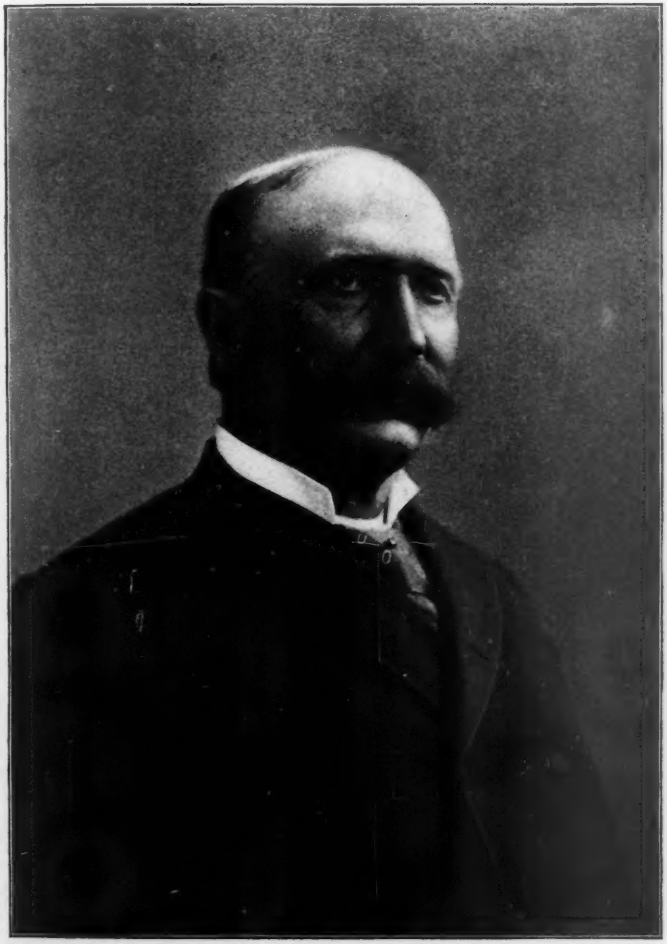
deeply religious nature, he introduced during his administration the offering of grace at the opening of each of our functions. To him should be ascribed the introduction of music as a feature in the programs of our meetings. His administration was very successful.

In September, 1888, there occurred a field-day gathering at Cambridge. After an inspection of the various features of the Cambridge water system, there followed a banquet, tendered by the city government and the Water Board.

During the following winter there occurred the four usual monthly meetings at Young's Hotel, Boston. Among the prominent papers presented were: "The Construction and Maintenance of Water Works," by the late Hon. Chester W. Kingsley; " Safe Ratio of Pumping Capacity to Maximum Consumption," by William B. Sherman; " Water in Some of Its Higher Relations," by Rev. D. N. Beach. In addition to the above, a large number of brief experience papers were presented and discussed.

We note the following names, among others, of new members elected during this period: John R. Freeman, Louis E. Hawes, Prof. Charles F. Chandler, William Paul Gerhard, Freeman C. Coffin, Horace L. Eaton, Byron I. Cook, Prof. Dwight Porter, Capt. James L. Lusk, and James L. Gale, the last-named being elected an honorary member.

The eighth annual convention, which occurred at Fall River, on June 12, 13, and 14, 1889, was one of the most enthusiastic gatherings we ever had. It was like a stiff southwest breeze from start to finish. There was something doing all the time, and no wonder, when one realizes that the entertainment features were directed by Patrick Kieran, William M. Hawes, and W. W. Robertson, all Fall River men. Those of us who have enjoyed the gracious hospitality of Patrick Kieran know that he is an artist of the first rank upon such occasions. I verily believe that Patrick Kieran is in his happiest mood when engaged in making bountiful provision for the entertainment of some friend. As for William M. Hawes, what a host he was! He always knew how to say in a cheery way the right thing at the right time, and merry peals of laughter were sure to follow. He was undoubtedly one of the most popular members our Association has ever had.



HIRAM NEVONS
President of the New England Water Works Association
1888-89

Our sympathy went to him a few years later when he was attacked by that long fatal illness, and when the end came we keenly felt that we had, indeed, lost a loving friend.

Among the papers presented at this convention were: " Hydrants," by George A. Stacy; " The Richmond Water Works," by Charles E. Bolling; " Friction in the Collection of Meter Rates," by George F. Chace; " Recent Progress in Biological Water Analysis," by Prof. W. T. Sedgwick; " Water-Works Records," by Albert S. Glover; " Pumping Engines," illustrated by lantern slides, by Prof. J. E. Denton. Among the names here added to the membership roll appear L. M. Hastings, E. H. Keating, and Robert K. Martin.

One incident was the acceptance of a gavel, which was presented from J. M. Diven, secretary of the American Water Works Association.

At the close of this convention Dexter Brackett became president, R. C. P. Coggeshall was reëlected secretary, Hiram Nevons was elected treasurer, F. H. Parker, senior editor, and Albert S. Glover, junior editor.

Shortly after this election a photographer appeared at the hotel with a camera, for the purpose of obtaining a snapshot of the newly elected president, for insertion in the newspaper report of the convention. Had the photographer requested a sitting, his request would, undoubtedly, have been granted, but he undertook to get the picture unbeknown to his subject. His object was discovered, and then followed some very amusing attempts to get the desired picture, all of which failed.

President Nevons brought his choir with him. The leader and bass singer was Francis L. Pratt, then the city messenger of the city of Cambridge. He was a fine singer and a fine leader. He was in constant attendance at our meetings for many years, and his singing was always popular. Whenever there was any lull in the discussions, President Nevons would make a requisition on the choir for an inspiring selection. It had the effect of making things lively. I think the closing exercises of this convention the most unique of anything of the sort that I ever attended. Everything was bubbling over with good cheer. Excitement was rampant, and all hands acted like a parcel of overgrown

schoolboys bent upon making a great big noise. At the close, the actions were pretty near the dimensions of a " breakdown " or a "cake walk." All hands were on their feet, — some dancing, some beating time, while the singers whooped it up on some two or three dozen verses of " Mary had a Little Lamb " to the tune of the " Battle Cry of Freedom." The congregation joined in the chorus:

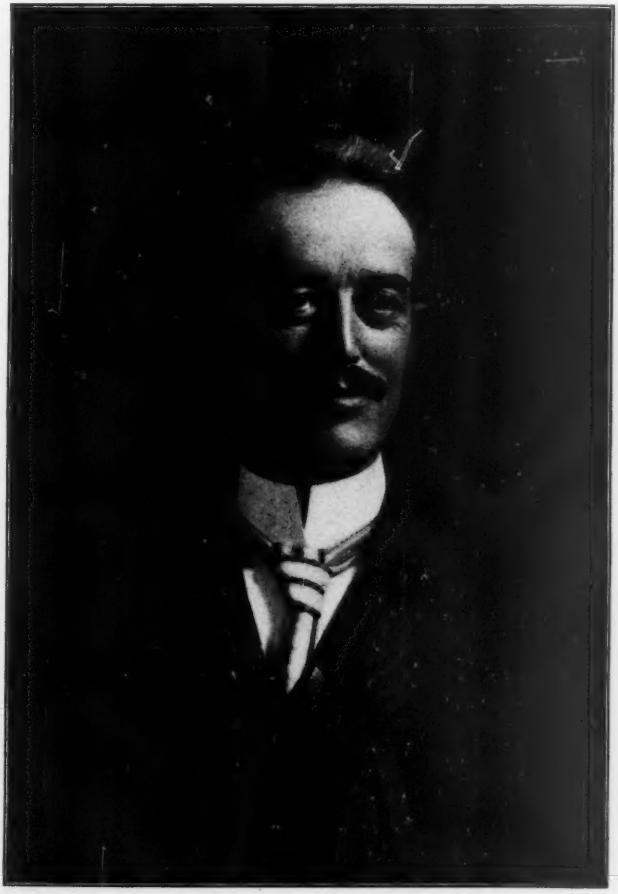
"Hurrah for Miss Mary!
Hurrah for the lamb!
Hurrah for the teacher,
Who didn't care a ———!
For we'll rally round the flag, etc."

The word " damn " was emphasized by the singers and the president with the explosion of dynamite torpedoes. William M. Hawes was an imposing spectacle as he stood upon a chair, thoroughly excited, waving his handkerchief, cane, and spectacles. Things grew blue and dusty, and thus the Fall River convention came to a close.

Charles E. Bolling, the able superintendent at Richmond, Va., and Capt. James L. Lusk, then in charge of the Washington, D. C., Water Department, made their first appearance at this time. Mr. Bolling made his bow to the Association with a carefully prepared paper, reviewing the details of the works under his charge. A few years later I was entertained by both of these gentlemen in their respective home cities. Mr. Bolling possesses a very attractive personality, and would be sure to become popular in any body with which he associated. Later he became the president of the American Water Works Association. Captain Lusk was, a few years later, transferred from Washington to service in other branches of the army. Neither of these gentlemen ever attended many of our meetings; I suppose the long distance made it an impossibility. As both were strangers to our section of the country at that time, I have often wondered what sort of an impression the unusual scene described above must have made upon them.

The ex-presidents whom I have heretofore mentioned, and who filled the space from the time of my presidency, in 1886, up to this period, have all faded from earthly sight. Dexter Brackett,

PLATE III.



DEXTER BRACKETT

President of the New England Water Works Association

1889-90

who assumed the presidency at this time, is an ex-president who is still young, very much alive, and a familiar figure to you all, and, what is still more to the purpose, he proposes to keep up his youthful ways and indomitable energy as long as he lives. He put a tremendous amount of labor into the work of his administration. There was no lack of inspiration while his hand was at the helm. He was a working president in every sense that the word implies. His deep interest in our affairs continues unabated, and the many helpful services which he is constantly rendering are always appreciated.

In the matter of entertainment, our Fall River friends offered a full program. At the close of one of the afternoon sessions the Association visited the new High School Building and inspected every part. In the hall in the upper part of the building is a marvelous cartoon by Kaulbach, entitled "The Era of the Reformation." The salient features of this picture were described by one of the lady teachers.

The last day was devoted wholly to entertainment. A visit to the pumping station was followed by a steamboat excursion. A landing was made at Bullock's Point, on the Providence River, where a shore dinner was served. In the speech-making which followed the dinner, some one referred to Rhode Island as a fertile state, to which William M. Hawes ventured the sally that she ought to be a fertile state, as she had the whole filth of Massachusetts draining down upon her. At the conclusion of these exercises the steamer was again boarded, and the party proceeded as far as Newport, where a landing was made. Leaving Newport, a direct return was made to Fall River.

In the following month of September an excursion was made to the White Mountains. Under the leadership of President Brackett, the party left Boston on the 29th, took dinner at the Pemigewasset House at Plymouth, and late in the afternoon arrived at the Crawford House, White Mountain Notch. Here they remained over Sunday. Visits to various points of interest were made upon that day. Our friend Joseph E. Beals made an involuntary test of the temperature of the water of "Beecher's Cascade," which those who witnessed will never forget — and I don't believe he ever will, either. The scenery upon

that quiet Sunday was grand. The mountain sides were ablaze with brilliant glory of autumnal tints, while the summits were capped with glistening snow. The return trip was made on Monday by the way of North Conway, where a stop was made and the party driven to various points of interest, after which a dinner was served at the Kearsarge House. It was a most enjoyable trip. We had our own private car, and many will remember our friend who rigged himself appropriately and acted as " water boy " to the party. We arrived in Boston that night in a drenching rain.

Early in December the series of monthly meetings was resumed at Young's Hotel, Boston. At the first meeting John R. Freeman, the eminent hydraulic engineer, presented one of the most valuable productions ever published by this Association. I refer to his well-known paper entitled, " Some New Experiments and Practical Tables Relating to Fire Streams." The January and March meetings were devoted to the presentation and discussion of short papers covering a wide range of subjects pertaining to our daily work. At the February meeting Mr. F. F. Forbes contributed an excellent study of " Algæ Growths in Reservoirs and Ponds." At this same meeting Prof. William T. Sedgwick joined our list of active members.

I have many times received tangible evidences of the good-will and esteem of the members of this Association. Twice this has come in the form of a generous surprise, which completely overawed me for the time. You will remember that I served as your secretary from the day of your organization until June, 1884, when I retired in favor of Albert S. Glover. At a field meeting three months later, at Woodland Park Hotel, Auburndale, Mass., I was called up, and William R. Billings, in your behalf, presented me with a magnificent engraving of Guido Reni's " Aurora." This incident was followed by Charles K. Walker addressing me, stating that he had been requested to give me a good caning. After humorous remarks, he placed a beautiful gold-headed cane, appropriately engraved as to occasion and date, in my hands. These treasures now adorn my home, and always bring pleasant memories to my mind as I view them. Then again upon the day of my marriage (April 29, 1890), there appeared

at the home of my bride a magnificent case of solid silver, accompanied with an elaborately carved solid oak writing desk. These came with your good wishes. It was a wonderfully pleasant surprise. I have never been able to adequately express my gratitude for the prominent part which you played in making that day for me what it ought to be in every similar case, *i. e.*, the happiest day in a man's life.

The ninth annual convention occurred at Portland, Me., June 11, 12, and 13, 1890. This convention will always remain noted as supplying a practical exponent of the element with which we deal. Water fell in profusion, and we were tempted to cry aloud to Heaven to deliver us from our friend. Of course the elaborate program of entertainment prepared by our Portland friends was completely upset by the drenching rain. We were to have gone to Lake Sebago upon the last day, but it was impossible to do this. Instead, we started for our respective homes. Some of our party, feeling that a second flood had been inaugurated, emulated the example of a certain Mr. and Mrs. Noah,— who, together with Ham, Shem, and Japheth, dodged impending disaster by fleeing to a certain ark, — and took passage to Boston by boat, feeling sure that as long as they were afloat they would be reasonably safe. But they gave no thought to the high wind, and when the boat gave evidence that she had reached the open ocean, then it was that Horace Holden, Frank Andrews, Uncle Jonas Clark, of Northampton, and others commenced to suffer with other troubles all their own. There was very little sleep upon the mighty deep that night.

It was a merry party which indulged in a trolley ride the evening before the convention opened. There were Mr. and Mrs. Brackett, Mr. and Mrs. Glover, Mr. and Mrs. Ross, Mr. and Mrs. Phipps, Mr. and Mrs. Coggeshall, and others whom I do not now recall. For over two hours we rode through various streets of Portland. We attracted considerable attention from the natives because of our vocal attainments. " Annie Rooney " was a popular selection then, and it surely was more than popular with our party that night, judging from the number of times it was repeated. It was a beautiful night, but we saw no more decent weather until after the close of the convention.

Our headquarters at Portland were at the Falmouth Hotel. Here it was that on the evening of the second day the Portland Water Company gave an elaborate banquet in our honor. We had fine music, and the banquet was followed by a set of interesting speeches. One of the drawbacks to our hotel quarters was the fact that the city of Portland was entertaining the Montgomery Light Guards, of Boston, at the same hotel at the same time, which had the tendency to make our accommodations somewhat cramped. George P. Wescott was treasurer of the Portland Water Company. He is at present, and has been for many years, a very prominent figure in many business enterprises throughout Maine. He was greatly interested in the success of this convention, had rendered valuable help in the preparation of the program, and had made generous provision in the matter of our entertainment at Sebago Lake. While he is a man of tremendous energy and push, the ceaseless rain at this time was too much for him, and thus his efforts failed to materialize.

Among the papers presented at this convention were: " The Effect of Water Hammer on Main Pipe and How Remedied," by J. C. Hancock, superintendent at Springfield, Mass.; Prof. William T. Sedgwick spoke upon " Surface Water for Drinking Purposes "; A. W. Locke, then engineer in charge of the Hoosac Tunnel, since deceased, presented some engineering notes made in Holland in 1887; P. F. Crilly read a paper entitled, " Why I Favor the Use of Cement Pipe "; G. A. Roullier, superintendent at Flushing, N. Y., read a paper entitled, " Water Meters, the Advisability of Their Use "; John A. Gould, of Boston, spoke concerning " Recording Gages "; C. W. Morse, of Haverhill, read a paper upon " Comparative Merits of Public and Private Management of Water Works," and one afternoon Alphonse Fteley, the chief engineer of the New York Aqueduct Commission, gave a very interesting and instructive talk upon the new Croton aqueduct, beautifully illustrated by lantern views.

At this convention Albert F. Noyes, of West Newton, was elected president, the incumbents of the offices of secretary, treasurer, and editor being continued in their respective places.

No member ever had a deeper interest in the welfare of this

Association than did Albert F. Noyes, our ninth president.* Joining this Association soon after its foundation in 1882, he remained a constant and enthusiastic attendant of its various gatherings until his tragic death in the Park Square Station in 1896. He was one of the most unselfish and sunny men I ever met. A pleasant speaker, always ready to take part in the discussions, his opinions were highly prized because of his wide experience, close observation, and sound common sense. He made many contributions to our literature, all of which appear in the pages of our JOURNAL.

In the month of September following, a very successful excursion was made to the Franconia Mountains. The party left Boston on Saturday. Dinner was served at the Pemigewasset House at Plymouth, and the Profile House, Franconia Notch, was reached late on Saturday afternoon. Here the party remained over Sunday, returning to Boston on Monday, *via* Pemigewasset Valley route.

The usual series of winter monthly meetings was held at Young's Hotel, Boston, commencing December 10. They were well attended and were very successful. Prominent among the papers presented at this period were: " Secular and Local Variations of Weather and Climate as Affecting Water Supplies," by Prof. W. H. Niles, president of the New England Meteorological Society; " The Filtration of Natural Waters," by Prof. Thomas M. Drown; " The Effect of Storage upon the Quality of Water," by F. P. Stearns, then engineer of the State Board of Health; " The Soft Answer," by L. H. Gardner, superintendent, New Orleans, La.; " Typhoid Fever in Its Relations to Water Supplies," by Hiram F. Mills, C.E.

The sessions of the tenth annual convention were held in Putnam Phalanx Hall, Hartford, Conn., on June 10, 11, and 12, 1891. There were not so many prominent papers presented at this convention as had been the case heretofore. The papers were largely descriptive of some personal experiences. E. E. Farnham, of Sharon, presented " An Experience with Water Hammer "; H. G. Holden, of Nashua, presented a paper entitled " Are Lead Pipe Connections for Iron Service Pipes Desirable? "

*A portrait of Mr. Noyes was published in the JOURNAL of March, 1897 (Vol. XI, p. 195)

J. C. Hancock, of Springfield, presented the subject, "The Risks Taken by a City or Town in having but One Supply Main"; George F. Chace, of Taunton, read a paper entitled, "Three Years' Experience with a Direct Pumping System"; Freeman C. Coffin, of Boston, presented a paper entitled, "Standard Flanges for Water Pipes"; Lucian A. Taylor gave a description of the New Haven Water Company's dam at Woodbridge, Conn.; F. F. Forbes, of Brookline, read an able paper entitled, "The Relative Taste and Odor Imparted to Water by some Algæ and Infusoria, and Thoughts Suggested by Studies in this Direction."

Besides the above there were a number of brief experience papers presented, and several topical discussions were introduced.

In his annual address delivered at the opening of this convention, President Noyes stated that "there has been a growing feeling among many of the members that the Association should have permanent headquarters." This was the first suggestion in that direction. At one of the later sessions a committee of five was appointed to take the matter into consideration and to report recommendations.

At one of the sessions a committee was also appointed to consider the question of a suitable badge, and to report recommendations.

One of the pleasant features of this convention was the music. The Cambridge musicians, led by Francis L. Pratt, who were introduced to us by Hiram Nevons when he was president, were present. It is hardly necessary to add that their work was almost always extremely satisfactory. I say almost always, because, owing to no fault of theirs, there was one occasion during this convention that they made a most ludicrous appearance. It occurred during a reception in the parlors of the Allyn House, at the close of the evening session upon the second day. The piano in the Convention Hall was all right, but no one had thought to look over the piano in the hotel. In reality it was in a horrible condition. When the musical program of that evening commenced, that piano gave out some of the most wretched discords you can possibly imagine. The artists were completely upset. Of course the musical attempt at this time was a flat failure, but everybody laughed and was good natured about it.

At the end of this convention, the Hartford Water Board enter-

tained the members of the Association with a ride to their storage lakes.

At the close of this convention, Horace G. Holden, of Nashua, assumed the presidential chair. The writer was reëlected secretary; Hiram Nevons, of Cambridge, was reëlected treasurer; Dexter Brackett succeeded F. H. Parker as senior editor; Walter H. Richards, of New London, succeeded Albert S. Glover as junior editor.

Albert S. Glover, who now retires from the office of junior editor, was one of our charter members. He served as secretary of this Association from June, 1884, to June, 1887; was treasurer from June, 1887, to June, 1889; and was junior editor from June, 1889, to June, 1891. When this Association was organized, and for a number of years following, he was water registrar of the city of Newton. I look back to many pleasant days spent with him in that city when we were considering the affairs of this organization. No member has the welfare of this Association more at heart than has he from the date of our organization up to the present time. He did an immense amount of work in our behalf. It was he who first suggested the plan of the quarterly JOURNAL, as it is now published, and its instant success was largly due to his intelligent business methods.

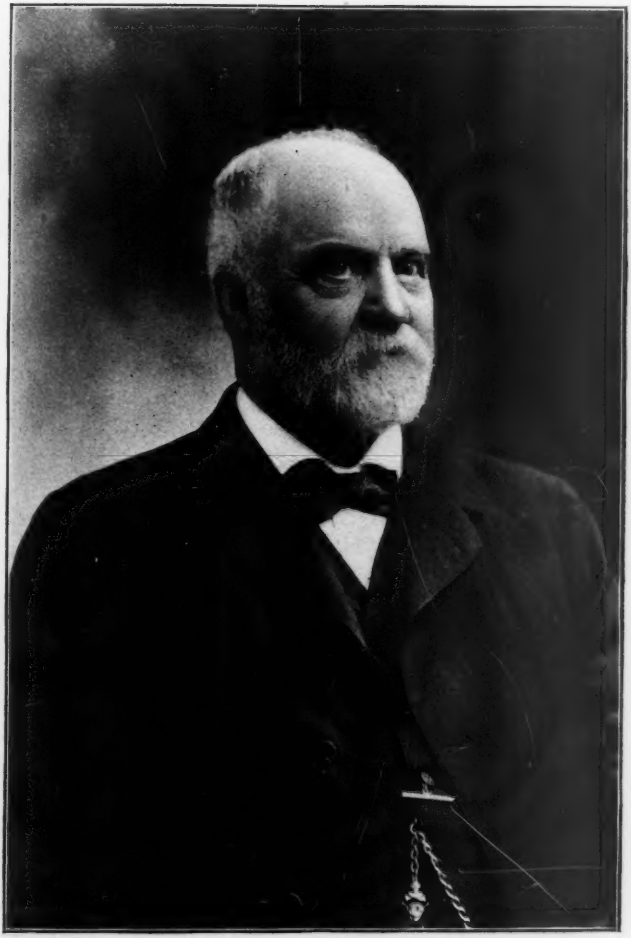
Walter H. Richards, of New London, who now became junior editor, had previously filled the same office for the year ending June, 1889. Previous to that time he had served as vice-president for the year ending June, 1885, also was a member of the Executive Committee from June, 1885, to June, 1888. I met him for the first time at the Worcester convention in 1883. At that time he took great interest in William B. Sherman's scheme for the exchange of sketches, and did all any one could do in helping promote that idea. I used to frequently meet him in connection with our affairs, and those meetings were delightfully pleasant and enjoyable. He was a hard and conscientious worker, and no duty assigned to him was ever neglected.

We now come to the administration of Horace G. Holden, our tenth president. As he appears to be pretty lively and healthy at the present time, it would be shocking to attempt any state-

ment having the tinge of an obituary notice about it. He is a familiar figure at our gatherings. You all know him well. His virtues are many, his faults few, his generosity unlimited, his good nature unbounded. You can't help liking him, for he compels every one he meets to do so. He was a member of the " old guard " which organized this Association on June 21, 1882, and he has continued to take an unabated interest in our affairs. He has always been a conscientious worker, and has done his share, and done it well. He has an innate love for the humorous and ridiculous. Nothing pleases him better than to be a participant in a good-natured joke. At one of the winter meetings at Young's during his administration a member was describing his method of laying a line of pipe. In commenting upon some of the details he illustrated the relative position of two objects by placing two silver forks upon the table. Instantly seeing the opportunity for a little fun, Holden put forth a series of very tactful inquiries, which soon resulted in the building of a wonderful model upon that table. It was necessary, of course, to give full play to the imagination to understand the details of this model. The fruit basket represented the reservoir, the main pipe was illustrated by knives and forks, stop gates by individual butter dishes, the standpipe by a banana, and hydrants by salt cellars. It was about as wonderful as the famous model of the Salt Lick Branch of the Pacific Railroad made by Col. Beriah Sellers.

On the 29th of the following September, an excursion was made to Salem, Mass. Here the party was met by representatives of the Standard Thermometer Company. The party was transferred by horse cars to the standpipe of the Peabody Water Works, where the working end of the electric indicator made by the Standard Thermometer Company was exhibited and explained, after which a trip was made to the Town Hall, where the dial end of the same indicator was examined. The factory of the Standard Thermometer Company was next visited, after which the party returned to Salem, and continued by train and ferry to the Corinthian Yacht Club House at Marblehead. Here they participated in an excellent dinner, after which a direct return was made to Boston.

On December 9 the usual series of four monthly meetings was



HORACE G. HOLDEN

President of the New England Water Works Association

1891-92

commenced at Young's Hotel. At this meeting Mr. Frederic P. Stearns, then chief engineer of the Massachusetts State Board of Health, presented a valuable paper entitled, "The Selection of Sources of Water Supply."

At this same meeting a committee was appointed to convey the sympathy of this Association to William M. Hawes, of Fall River, who had then been the victim of a prolonged illness. This resulted in presenting him on Christmas Day with a silver pitcher and goblet properly inscribed.

At the January meeting Mr. Reuben Shirreffs, then second assistant engineer of the East Jersey Water Company, gave an elaborate talk, illustrated with lantern views, upon " The New Water Supply of Newark, N. J., with Special Reference to the Riveted Steel Pipe Conduit."

The February and March meetings were devoted to the presentation and discussion of a number of brief " experience " papers.

The eleventh annual convention was held at Hotel Hamilton, Holyoke, Mass., on June 8, 9, and 10, 1892. In his annual address President Holden suggested a change of time for holding the annual meetings. He also renewed the suggestion of President Noyes, made the previous year, in regard to permanent headquarters, and hoped " that the time was not far distant when we can afford to have good quarters, centrally located."

Prominent among the papers presented at this convention were the following: " Fire Protection," by George A. Ellis; " The Arrangement of Hydrants and Water Pipes for the Protection of a City against Fire," by John R. Freeman; " The Venturi Water Meter," by R. A. Robertson, Jr.; " The Purification of Drinking Water by Sand Filtration," by Prof. William T. Sedgwick; " The Effect of Aëration of Water and Sewage," by Prof. Thomas M. Drown; " The Franklin, N. H., Water Works," by F. L. Fuller. Besides the above there were a number of excellent experience papers and discussions.

The Committee on Badges rendered their report, and the result was the adoption of the badge with which you are now all familiar.

We were treated with great hospitality by our Holyoke friends, and were shown the important features of their city. One after-

noon we were treated to an excellent organ recital, and on the last day we were carried to Mt. Holyoke, at the summit of which we were served with an excellent lunch while enjoying the magnificent view. The Holyoke convention was certainly a most enjoyable outing.

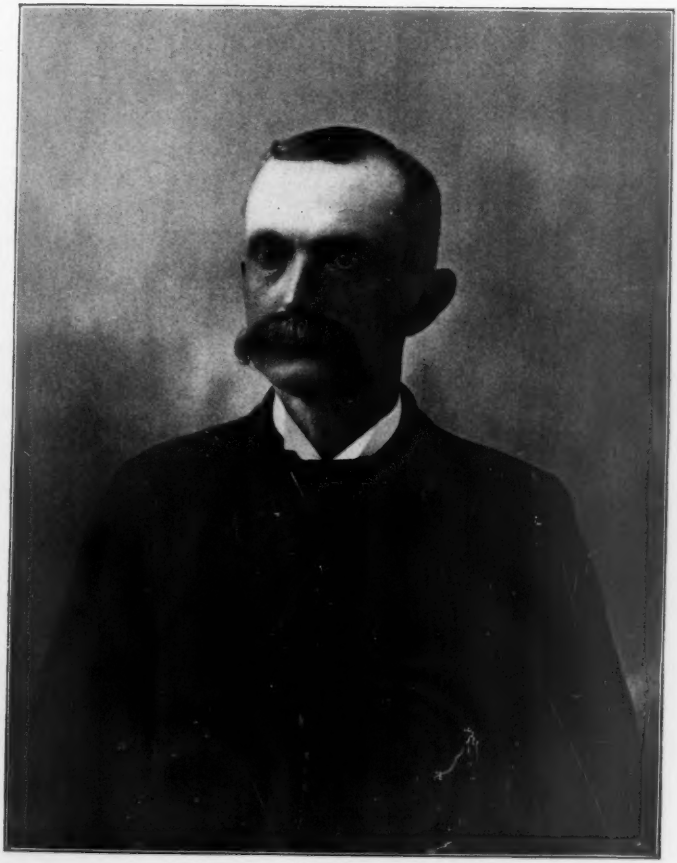
At the close of this convention George F. Chace, then superintendent at Taunton, Mass., became president. The editors, secretary, and treasurer of the previous year were reëlected.

George F. Chace is another ex-president who is very much alive at the present time. He is a familiar figure at our various gatherings, and is known to you all as possessing literary ability of no ordinary character. He has presented us with many interesting papers for our discussion and entertainment. He was an excellent president and gave a very successful administration.

The fall excursion took place at Middleboro, Mass., on September 14. The generous hospitality displayed made it one of the most delightful outings in our history. A very pretty and pleasing surprise was a short reception at the Town Hall, when a delegation of ladies, under the leadership of Mrs. J. E. Beals, decorated each member with a boutonnière. Then a lunch followed. Later in the day, after visiting various points of interest, we had a shore dinner at Lake Assawompsett. The entire program was carried out by the entertainers with a life and vim which many a more pretentious affair has lacked. All the visitors were enthusiastic in regard to their reception.

Commencing with December 14, the usual four winter meetings were held. They were almost entirely devoted to short experience papers and discussions of the same. At the December meeting, W. H. Richards, of New London, gave lantern views, with description of features connected with his new " high service " system. At this same meeting, both Desmond FitzGerald and Dexter Brackett gave interesting descriptions of work under their charge, illustrated by lantern slides. We now begin to hear something regarding electrolysis of water pipes; C. H. Morse, of Cambridge, giving us an address upon the subject at the January meeting.

At the February meeting Freeman C. Coffin presented a paper upon " Standpipes, " which was followed by Mr. A. Prescott



GEORGE F. CHACE

President of the New England Water Works Association

1892-93

Folwell, who gave a description of a novel standpipe erected at Atlantic Highlands, N. J. At the March meeting Mr. L. M. Hastings presented a paper entitled, "Description of a Method of Estimating the Loss of Water Power in a Stream by Taking Water therefrom for a City Supply." Interspersed among the papers above named were introduced a large number of brief experience papers and topical discussions.

The twelfth annual convention occurred at Worcester, Mass., on June 14, 15, and 16, 1893. The Bay State House, where arrangements had been made for our accommodations, having been damaged by fire a few days previous to the date of our meeting, our headquarters were transferred to the Waldo House. Although our quarters were somewhat cramped, yet we were delightfully entertained. The most important papers include the following: " The Placing of a Large Steel Submerged Pipe in Skaneateles Lake for the Syracuse Water Works," by William R. Hill; " The Works of the East Jersey Water Company for the Supply of Newark, N. J.," by Clemens Herschel; " Purification of Water by Freezing," by Prof. T. M. Drown; " Water Pipe Trenches *vs.* Good Roads," by W. E. McClintock; " Recent Practice in Pumping Machinery," by F. W. Dean; " Is the Game Worth the Candle? " a paper relating to meters, by John Thomson; " An Illustrated Description of the Hydraulic Laboratory of the Massachusetts Institute of Technology," by Prof. Dwight Porter. There were also a number of topical discussions, prominent among which was one on " Details of Pipe Castings and Coating."

The entertainment feature at this convention was elaborate. We were driven to various points of interest. We witnessed the trial of a number of large fire streams. We were carried to Lake Quinsigamond, and to indicate how delightfully accommodating they were, they stopped the train on the passage there to allow Joseph E. Beals to recover his hat which had blown off. At the lake we were entertained in various ways. Those of us who saw Nathan B. Bickford sit for a photo of himself which he presented Charles K. Walker will not be likely to soon forget that event. The dinner and speech-making which followed were delightful, and we returned home well pleased. At the close of the convention George E. Batchelder, of Worcester, became president.

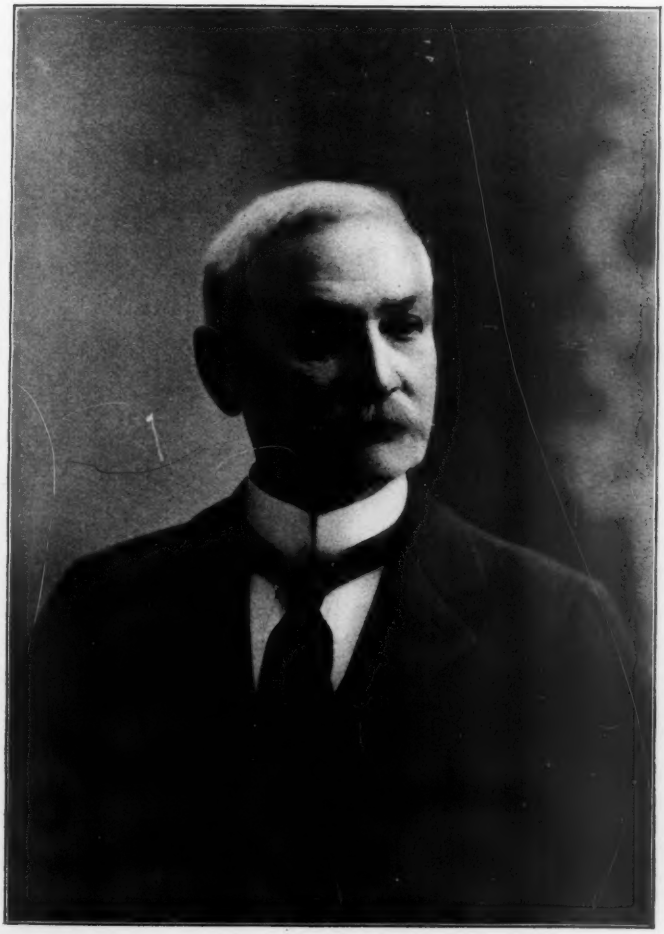
The editors, secretary, and treasurer of the previous year were reëlected.

George E. Batchelder had a most attractive personality. He made strong friends of those associated with him. He seldom missed a meeting, and although he was naturally very quiet in his manner, he was not a passive member by any means. His wise counsel and sound advice were always acceptable and respected. He made an admirable president, and at the close of his administration he was elected treasurer, succeeding Hiram Nevons who had then recently died. This position he continued to acceptably fill up to the date of his own death, which occurred in 1899.

The fall excursion of 1893 was held at Plymouth, Mass. It consisted of a visit to the points of historical interest, also a visit to the pumping station of the Plymouth Water Works, followed by a dinner at Hotel Pilgrim. The day was clear and bright. The program was smoothly executed, and every one had a delightful outing.

During the following winter months there occurred the four usual meetings. That of January was held at the Parker House, all the others at Young's Hotel. Prominent on the program appear the following: " Covered Reservoir at Brookline," by F. F. Forbes; " Water Supply at Waltham," by George E. Winslow; " Basin and Well Covering of the Waltham Water Works," by F. P. Johnson; " The Construction of Reservoir Embankments," by Lucian A. Taylor; " The Bursting of the Portland Reservoir," by John R. Freeman; " The Filter at the Wannacomet Water Works, Nantucket, Mass.," by William F. Codd; " The Fairhaven Standpipe," by Joseph K. Nye; " The Electrical Purification of Water," by Prof. T. M. Drown. Intermingled with the above were a number of valuable experience papers and topical discussions.

The thirteenth annual convention occurred at the United States Hotel, Boston, Mass., on June 14, 15, and 16, 1894. The address of welcome given by Hon. Nathan Matthews, Jr., then mayor of Boston, is worthy of more than a passing notice. It was a thoughtful presentation of the financial side of a waterworks supply, with suggestions as to how the existing conditions



GEORGE E. BATCHELDER
President of the New England Water Works Association
1893-94

might be improved. Several of the daily papers commented editorially upon it, and during the convention a committee was appointed to take the matter of this address under consideration and to report at a future convention.

The important papers presented at this convention were, "Laying a Sixteen-Inch Main across a Rocky Mill Stream and over a Dam," by George F. Chace; "The Water Service and Fire Protection of Theaters," by William Paul Gerhard; "Remarks Concerning a Recent Paper on the Flow of Water in a Compound Pipe," by George A. Ellis; "Electrolysis of Water Pipes," by C. A. Stone and Howard C. Forbes; "The Care of a Water Meter," by J. C. Whitney; "Experiments with Tube Wells at Lowell," by George Bowers; "The Lawrence Filter and Its Results," by Hiram F. Mills; "What a Water Supply Engineer can do in the Fire Department," by James E. Taylor, of Detroit; "A Few Examples of High-Grade Pumping Engines," illustrated by stereopticon views, by E. D. Leavitt.

The excursion made during this convention was more largely attended than usual. On Friday a party of over two hundred were taken to Echo Bridge, the Newton, Brookline, and Chestnut Hill pumping stations. On Saturday a still larger party spent the day in a delightful sail around Boston Harbor, stopping at the Sewage Pumping Works and at Fort Warren.

This was a highly successful convention from every point of view. At its close George A. Stacy, of Marlborough, became president. George E. Batchelder was elected treasurer, and the editors and secretary of the previous year were continued in office.

George A. Stacy, the thirteenth president of this Association, joined our ranks in April, 1885. He has always been deservedly popular. He early attained prominence in our affairs by reason of his remarkably intelligent discussion of the various problems brought before us. He has always been willing to do all he could to contribute to the success of our gatherings. He infused into his presidential work the same indomitable energy and push which has always been characteristic of the man. In consequence, he gave us a highly successful administration.

On the following September 22d, an excursion was made to the

Crawford House, White Mountain Notch, and a most delightful Sunday was passed at this spot. Some of the party ascended Mt. Washington, others took in the beautiful view from Mt. Willard. My memory at this time goes back as one of about thirty-five who visited the historic " Willey " House, in an attempt to find some of the relics of the memorable land slide. Visitors were allowed to enter the house. There was an entire absence of such historical relics as might have been provided to appeal to the imagination. One could not imagine a more bare, dirty, and unattractive interior. To some of the party who had been expecting much it was positively repelling. They wanted to get out as quickly as possible. This they attempted to do, but when the door was reached, lo, the doorkeeper blandly held out his hand saying, " Twenty-five cents, please," although nothing had been said regarding this fee when you entered. Some years previous, I had been a victim to this extortion, and it struck me so humorously that I was willing to sacrifice fifty cents to witness the effect upon my wife, who was then visiting the spot for the first time. So we entered the house. I had not dreamed that the remaining thirty-three would follow, but they did. There was absolutely nothing to see except an old piece of dirty straw matting. My wife asked to see the Bible and candlestick, which were relics of the landslide days. They could not be produced. A more disgusted lot of pilgrims you never saw. But as we filed out the door in exit, and each one contributed a quarter into the upturned palm of the keeper, a smile, yea, even more, spread over each countenance. You should have seen George Stacy as I saw him. He shook his head, slapped his arm, burst into a loud laugh, and declared it was the best sell he had ever seen and he would not have missed it for the cost of several quarters. Some one remarked that if this sort of thing had been going on for many years that " Little Willie's grave ought to be covered with a mountain of quarters." Subsequently, William B. Sherman, who was one of the party, made a caricature of the event, a blue-print copy of which he sent to each of the party. I herewith supply a copy of that blue print.

PLATE VII.

GEORGE A STACY

President of the New England Water Works Association

1894-95

The following is a list of names which do not now appear upon our membership list, who served this Association in some official capacity previous to 1895.

Henry W. Ayres,
Benjamin S. Babcock,
George E. Batchelder,
William R. Billings,
J. C. Broatch,
J. Stewart Brown,
John L. Congdon,
S. S. Coolidge,
J. Warren Cotton,
Edwin Darling,
Charles R. Dyer,
George A. Ellis,
Sherman E. Granniss,
Walter H. Harding,
John L. Harrington,
John C. Haskell,
James H. Hathaway,
William M. Hawes,
Nathaniel I. Jordan,
Joseph L. Kenney,
James W. Lyon,
Alfred H. Martine,
Willis E. McAllister,
Alvoid O. Miles,
Charles W. Morse,
Hiram Nevons,
Albert F. Noyes,
F. H. Parker,

Henry W. Rogers,
A. H. Salisbury,
Frederick W. Sawyer,
Henry L. Schleiter,
Phineas Sprague,
Joseph G. Tenney,
Herbert F. Whittier.

Scarcely more than a third of the above list are now living.

By turning back to our records you will note that a group of twenty-seven organized this Association on June 21, 1882. Seventeen of those charter members have served the Association in one or more official capacities. To-day only six of that seventeen remain active in our ranks, *i. e.*, Thomas C. Lovell, Frank E. Hall, Horace G. Holden, Albert S. Glover, Charles K. Walker, R. C. P. Coggeshall.

I will here draw this series of reminiscences to a close. A few months later circumstances compelled me to present my resignation, and my official connection with the Association, as your secretary, came to an end on January 9, 1895.

Since this date the following have served as your presidents:

1895–96, Desmond FitzGerald of Brookline, Mass.
1896–97, John C. Haskell of Lynn, Mass.
1897–98, Willard Kent of Narragansett Pier, R. I.
1898–99, Fayette F. Forbes of Brookline, Mass.
1899–1900, Byron I. Cook of Woonsocket, R. I.
1901, Frank H. Crandall of Burlington, Vt.
1902, Frank E. Merrill of Somerville, Mass.
1903, Charles K. Walker of Manchester, N. H.
1904, Edwin C. Brooks of Cambridge, Mass.

With the exception of Mr. Merrill all those named above were members during my secretaryship.

This paper would not be complete without a testimony of appreciation of the admirable work which has been accomplished by that eminent engineer, Desmond FitzGerald. He joined this Association in 1885. He has until lately been a frequent attendant at our gatherings. His sound discussions and valuable counsels were always a source of profit and inspiration. We all regretted that ill-health compelled him, a year or two ago, to sever his connection with those activities which have been

DESMOND FITZGERALD

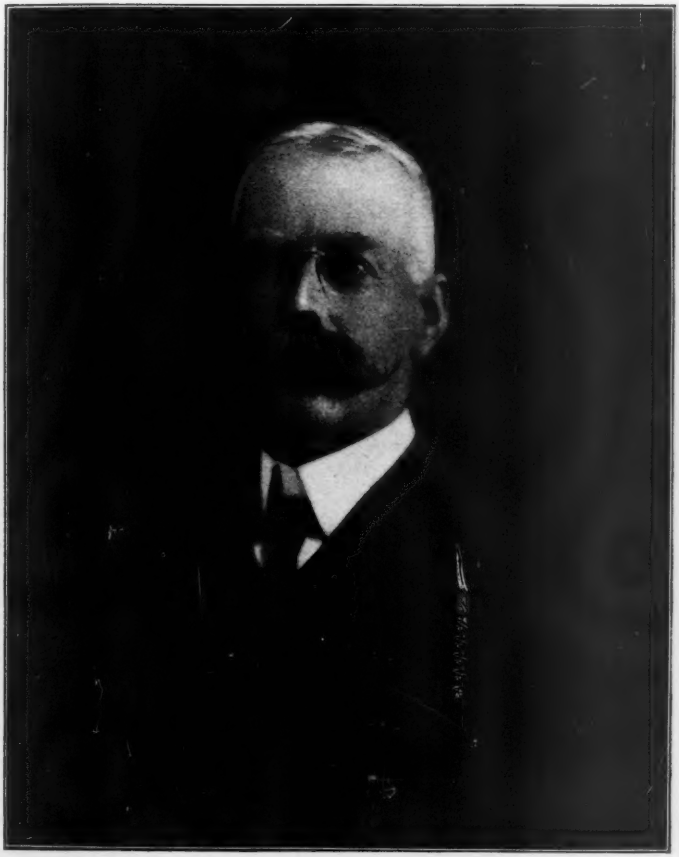
President of the New England Water Works Association

1895-96

PLATE IX.

JOHN C. HASKELL
President of the New England Water Works Association
1896-97

PLATE X.

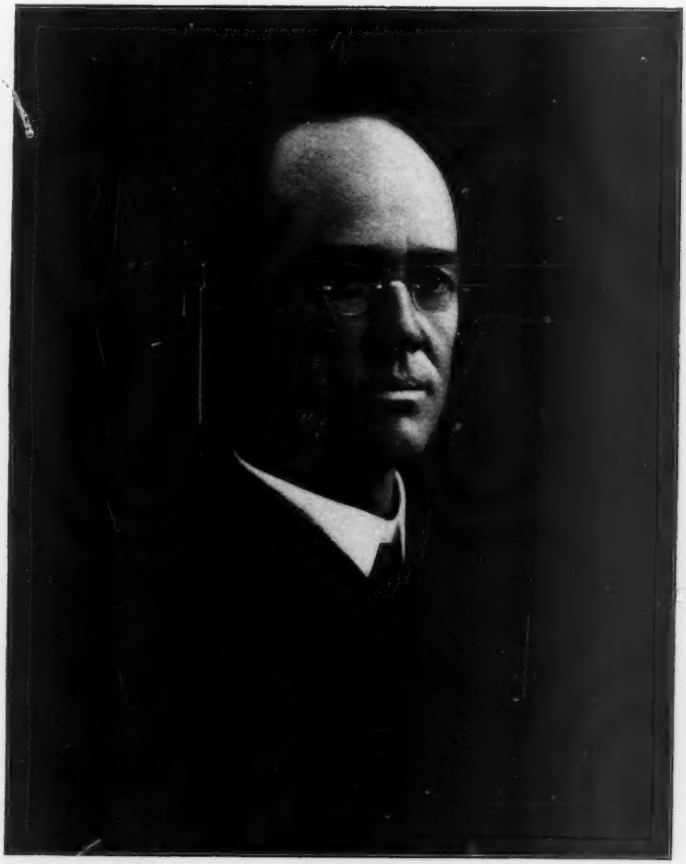


WILLARD KENT

President of the New England Water Works Association

1897-98

PLATE XI.



BYRON I. COOK
President of the New England Water Works Association
1899-1900

PLATE XII.

FRANK H. CRANDALL
President of the New England Water Works Association
1901

his life work, and are glad to learn that his health is now fully restored.

With the exception of John C. Haskell, all those named above are still good active members of this Association.

You are all familiar with the appearance of the dignified, smooth-faced gentleman who always sits in front of our presiding officer, quietly taking shorthand notes of what is said, but I take it that there are only a very few among us who really appreciate his value as a servant of this Association. He is certainly worthy of your highest praise. He has given you a continuous service from the time of the New Bedford convention, in 1886, up to the present time, and he is indeed an old friend. To the intelligent and well-ordered mind of James P. Bacon should be given a large proportion of credit due for the extremely satisfactory reports of our meetings which appear in the pages of our JOURNAL.

It was always a pleasure to meet our honorary members,— Mr. Frost of the *Engineering News*, Mr. Meyer of the *Engineering Record*, and Mr. Shepperd of *Fire and Water*. These gentlemen rendered us many kind services, and always showed a disposition to do what they could in the direction of enhancing our prosperity. The same is true of our associate membership. There are many in their ranks who have an interest beyond the bounds of trade. More than one excellent paper and many intelligent comments and discussions have been contributed from this class of membership.

But I am here reminded that I have failed to mention a large number of deserving names, all of whom have been important factors in our affairs during the period which I have attempted to cover. There is no question regarding the credit due all such, but to include all of them would be to further extend this paper which has already reached beyond a reasonable limit.

One might judge from the tone of this paper that the Association has had an unusually serene and peaceful existence, and that dissensions apt to be found in such bodies have found no lodgment here. In a way this is true. We have been remarkably free from the effects of strife and animosity. But there have been times when the membership has been divided upon questions which caused more or less feeling. This state of things, however,

never continued long. A way always appeared to quickly smooth the troubled waters. I remember several years since, how that great engineer and no less great man, Alphonse Fteley, rendered this Association a valuable service by acting as arbitrator over a question upon which there was a disagreement among prominent members. His decision was gracefully given, loyally accepted by both parties, and all differences quickly healed and forgotten.

We have now entered upon the twenty-second year of our life. Nearly ten years have passed since I ceased to be prominent in your activities. You did me the honor at that time to say many pleasant things concerning the result of my work. Let me now call your attention to the fact that the Association has since continued to prosper in all good ways. While you have been blessed with leadership equally as good if not superior to that which you had in the past, yet I firmly believe that a large share of our present prosperity is due to our loyal membership. Their aim is high and they do not fall short of the target. The one grand object of this Association is to seek the truth, first, last, and always, never minding where it may be found and whose personal advantage is thereby destroyed. Upon such a foundation the pioneers of this Association began to rear the superstructure of our temple. Thus far we have builded well, and there has been little time when our voyage has been upon other than a calm and placid sea.

I congratulate you upon the past, and predict that, like the well-nourished youth who outgrows his boyhood days, and develops as he enters the ranks of a sturdy manhood, so will this body continue to enlarge its sphere of activities as the years go by, thus enabling it to more satisfactorily cope with any problem in which we are all mutually interested.

PROCEEDINGS.

June Excursion.

Wednesday, June 22, 1904.

The June outing of the Association was devoted to a trip by steamboat *King Philip* down Boston Harbor, around the wreck of the steamship *Kiowa*, to Hull, where, by courtesy of Mr. L. S. Doten, the engineer, the party was permitted to inspect the concrete-steel standpipe recently built for the fort; and to Nantasket Point, where dinner was served at the Nantasket Point Hotel. Electric cars furnished by the Old Colony Street Railway Company were then taken, and the party rode to Quincy Point, where the new power station of the company, in which five steam turbines will be installed, is being fitted up. After an examination of the station, the party again boarded the *King Philip* and returned to Boston.

The attendance was as follows:

Members.

S. A. Agnew, C. H. Baldwin, L. M. Bancroft, E. C. Brooks, Fred. Brooks, G. A. P. Bucknam, James Burnie, G. F. Chace, M. F. Collins, W. R. Conard, G. E. Crowell, E. R. Dyer, E. H. Foster, F. L. Fuller, H. F. Gibbs, J. C. Gilbert, T. C. Gleason, A. S. Glover, R. A. Hale, J. O. Hall, J. C. Hammond, Jr., G. H. Hart, V. C. Hastings, T. G. Hazard, Jr., D. A. Heffernan, H. G. Holden, J. L. Howard, E. W. Kent, Willard Kent, William A. Kilbourn, G. A. King, C. F. Knowlton, H. V. Macksey, D. A. Makepeace, W. E. Maybury, F. L. Northrop, H. E. Perry, G. W. Ricker, W. W. Robertson, G. A. Sanborn, E. M. Shedd, C. W. Sherman, G. H. Snell, G. A. Stacy, J. T. Stevens, J. J. Sullivan, W. F. Sullivan, H. L. Thomas, W. H. Thomas, J. L. Tighe, G. W. Travis, C. K. Walker, G. E. Winslow. — 53.

Associates.

Ashton Valve Co., by C. W. Houghton; Chapman Valve Mfg. Co., by Edward F. Hughes; Coffin Valve Co., by H. L. Weston; Fred C. Gifford; Greenwood & Daggett Co., by G. F. Chace; Hart Packing Co., by Horace Hart; Hersey Mfg. Co., by Albert S. Glover and H. D. Winton; Fred A. Houdlette & Son, by

Fred A. Houdlette; Jenkins Bros., by Ernest Schmeliat; Lead Lined Iron Pipe Co., by Thomas E. Dwyer; Ludlow Valve Mfg. Co., by H. F. Gould; Mueller Mfg. Co., by H. L. Dickel; National Meter Co., by Charles H. Baldwin and J. G. Lufkin; Neptune Meter Co., by W. H. Van Winkle; Norwood Engineering Co., by H. W. Hosford; Perrin, Seamans & Co., by J. C. Campbell; Rensselaer Mfg. Co., by F. S. Bates and Charles L. Brown; Ross Valve Co., by William Ross; A. P. Smith Mfg. Co., by D. F. O'Brien and F. W. Whitcomb; Sumner & Goodwin Co., by H. A. Gorham; Sweet & Doyle, by H. L. DeWolfe; Thomson Meter Co., by S. D. Higley; Union Water Meter Co., by F. L. Northrop; R. D. Wood & Co., by William F. Woodburn. — 28.

GUESTS.

S. M. Spencer, E. A. Winchester, D. L. Millikin, Malden, Mass.; Mrs. Edwin C. Brooks, Cambridge, Mass.; Raymond Kent, East Cambridge, Mass.; Mrs. E. W. Kent, Woonsocket, R. I.; Mrs. C. W. Houghton, F. W. Smith, M. C. Smith, Miss Helen Willson, W. G. Ruggles, Mrs. Horace Hart, Boston, Mass.; Frank L. Weaver, Member Water Board, Charles L. Varnum, James Whittet, Mrs. C. S. Proctor, Lowell, Mass.; Mrs. H. G. Holden, Mr. and Mrs. N. R. Lougee, Miss Gertrude Lougee, Wilder M. Gates, W. H. Greenleaf, Nashua, N. H.; O. P. Richardson, Major E. R. Horton, Attleboro, Mass.; H. D. Parsons, F. H. Dewey, C. N. Oakes, Westfield, Mass.; Mrs. G. E. Winslow, Waltham, Mass.; J. F. Gleason, Mrs. J. F. Gleason, Quincy, Mass.; Mrs. W. E. Maybury, Braintree, Mass.; Mrs. M. E. Phillips, Weymouth, Mass.; John Kelley, Claim Agent Old Colony Street Railroad, Braintree, Mass.; Henry A. Desper, Worcester, Mass.; M. L. Felet, L. P. Stone, Natick, Mass.; Thomas Burke, Mrs. George A. Stacy, Marlboro, Mass.; Mrs. D. A. Heffernan, Milton, Mass.; Mr. McCallum, Whitman, Mass.; W. H. Patterson, Providence, R. I.; Mrs. William A. Kilburn, South Lancaster, Mass.; Charles E. Childs, Somerville, Mass.; George W. Fiske, Manager, Fall River Street & Gas Pipe Company, Fall River, Mass. — 44.

(Names counted twice. — 4.)

No business meeting of the Association was held.

EXECUTIVE COMMITTEE.

MAY 19, 1904.

Present: President Edwin C. Brooks and Messrs. Frank E. Merrill, Edmund W. Kent, Horace G. Holden, George E. Crowell, Lewis M. Bancroft, Joseph E. Beals, Charles W. Sherman, George A. Stacy, Robert J. Thomas, and Willard Kent.

Also present: Messrs. Michael F. Collins, of the Committee on

Annual Convention, and William E. Maybury, of the Committee on June Excursion.

A letter from R. D. Wood & Co. in relation to uniformity of hose threads was read, and on motion of Mr. Thomas, seconded by Mr. Bancroft, the President was authorized to appoint a committee of three to consider the subject and report to the Association.

Mr. Maybury of the Committee on June Excursion reported that the Steamboat *King Philip* could be chartered for the day for two hundred dollars ($200) and that dinner could be secured at the Nantasket Point Hotel at seventy-five (75) cents per plate. Whereupon it was —

Voted: That the date of the excursion be fixed at June 22, and that the steamboat *King Philip* be chartered, and arrangements made with the Nantasket Point Hotel for dinner on that date.

Voted: That Mr. Frank E. Merrill be added to the Committee on June Excursion.

Voted: That Mr. Frank E. Merrill be appointed Transportation Agent to make necessary arrangements with the railroads for reduced fares on the occasion of the Annual Convention in September next, to be held at Holyoke, Mass.

Two applications for membership were received and approved.

Adjourned.

Attest:

WILLARD KENT, *Secretary.*

ON BOARD STEAMBOAT "KING PHILIP,"
Wednesday, June 22, 1904.

Present: President Edwin C. Brooks and Messrs. V. C. Hastings, George E. Crowell, George A. Stacy, Lewis M. Bancroft, Edmund W. Kent, J. C. Hammond, Jr., Horace G. Holden, Charles W. Sherman, Willard Kent.

Eight applications for membership and one for associate membership were received and approved.

Adjourned.

Attest:

WILLARD KENT, *Secretary.*

OBITUARY.

JAMES E. BURKE, secretary and treasurer of the Princeton (N. J.) Water Company, died on February 23, 1904.

Mr. Burke was in his fiftieth year, and had lived in Princeton all his life. He had always been prominent in the public affairs of the community. He was a prominent Democrat, and in 1899 was candidate for the office of sheriff of Mercer County. He had been connected with the Princeton Water Company almost from its inception in 1883. In addition to his position with the water company, he was treasurer of the Princeton Savings Bank, and had been secretary and treasurer of the Princeton Gas Light Company until it was merged into the Princeton Lighting Company.

He was elected a member of the New England Water Works Association on September 11, 1895.

GEORGE DEVERE CURTIS, assistant engineer in the office of the City Engineer of Boston, died June 26, 1904, from an operation for appendicitis.

Mr. Curtis was born August 30, 1863, at Belleville, Ont., and after a public school education, he was, at the age of eighteen, articled for two years to Sir Archibald Ponton, and at once proceeded to the Northwest Territory in the work of the government surveys. In 1883 he came to the United States and entered the employ of the Smead Heating and Ventilating Company, where he remained until 1894. He worked for this firm at various places, among others Toledo, Denver, and Elmira; at the latter place being the manager of the Drafting Department. He designed various systems of heating and ventilating, especially for large

buildings, patenting several improvements along this line. He was a part owner in the company until the financial crash of 1893 came, compelling the failure of the concern.

In the spring of 1895 he entered the City Engineer's office of Boston, where he remained until his death. He was employed on the water works, and did excellent work in designing and systematizing the various castings of the department. He also had charge of the fire supply system for the Boston City Hospital. He was about to patent an improvement in hydrants when his untimely decease occurred. His work always showed the marks of extreme fineness and accuracy.

He combined an even, cheerful temperament with an aggressive ability to achieve results, and his unselfish character was especially noted by all with whom he came in contact.

He joined this Association September 19,1900, and he was also a member of the Boston Architectural Club.

He was married in 1893 to Miss Fannie Hagar, of Richmond, Me., who survives him.

DWIGHT A. HARRIS, superintendent of water works at New Britain, Conn., committed suicide by shooting, and died June 16, 1904.

Mr. Harris was born in Boonville, N. Y., September 17, 1850. He had lived in New Britain about twenty-five years. Having been a plumber by trade, he was at first called in to do odd jobs and make repairs for the water works, which were then too small to require the constant services of one man. Later Mr. Harris was chosen to have the care of the works, and he was superintendent until his death.

He was elected a member of this Association on March 14, 1888.

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CORRECTION.

In September, 1904, JOURNAL, page 308, ninth line, for Walter E. Stearns read Arthur E. Stearns.